MOTORWAY HELSINKI – LAHTI
section
TATTARIHARJU – JÄRVENPÄÄ

Economic justification

FINLAND

NATIONAL BOARD OF PUBLIC ROADS AND WATERWAYS
1969, march

CONTENTS

1. Summary

The purpose of the Project is to construct a 23 km long motorway section between Tattariharju and Järvenpää (see Fig. 1, p. 2). The construction costs of the Project included in the Loan Programme are about 76 Million Fmk. Added with acquisition costs, about 15 Million Fmk and with costs of works financed by communes, about 3 Million Fmk, the overall costs amount to 94 Million Fmk. The road forms part of the Motorway Helsinki-Lahti-Lusi, of which the section Koskela-Tattariharju is partly completed partly under construction. Extending the motorway from Järvenpää to Lahti and further on to Lusi is being planned.

According to the General Traffic Census of 1965 the average traffic volume of section Tattariharju-Järvenpää on Main Road 4-5 (Helsinki-Lahti) was 5 430 automobiles (AADT). The width of the main road is 7 metres and that of shoulders from 1.5 to 2.0 metres. The main purpose of the Project is to eliminate the existing capacity problems.

The implementation of the Project has been planned in stages so that the age of interchanges will be about 15 years after which they will be furnished with additional ramps. The approach roads to urban localities starting from interchanges are planned as single-carriageway roads at the first stage. Second carriageways will be constructed later on as required by traffic. Section Kuninkaanmäki-Vaarala will be built first as a 2+2 lane motorway and additional lanes (3+3) will be constructed in about 1985.

Judging on the basis of today's planning phase, the Tattariharju-Järvenpää Motorway could be opened to traffic in autumn 1972. The road user benefits of the Project in 1975 will be about 11 per cent of the overall costs. The benefits in road user costs obtained during 1972-81 discounted with a 7.5 % interest to 1972 covers the total cost of the Project.

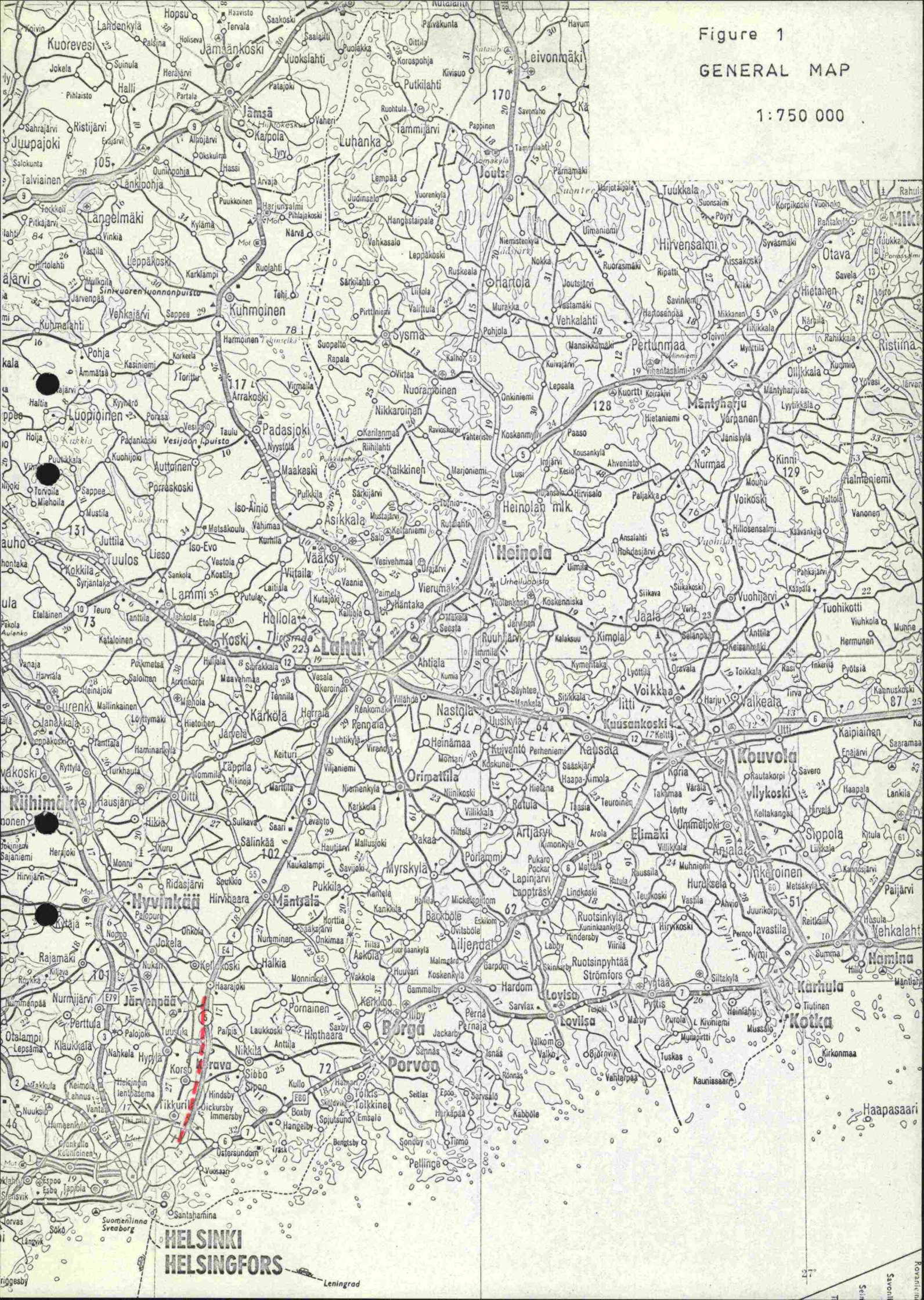


Figure 1

GENERAL MAP

1:750 000

2. Land Use

2.1 Location

The traffic influence areas of the Tattariharju-Järvenpää Road have been determined on the basis of traffic flow information of the Helsinki Metropolitan Transportation Study (1965-1967). The share of areas of the traffic of the Tattariharju-Järvenpää Road was as follows (AADT 1965):

	%
Helsinki Area	43.1
Roadside Area	23.9
Lahti Area	14.1
Northern Area	8.9
Mäntsälä	5.6

These areas have 95.6 per cent of the traffic of the road section.

The existing road forms part of Main Road 4-5 connecting Helsinki to Central and Northern Finland. The towns of Lahti (85 409 inh. at the end of 1967), Heinola (13 522), Jyväskylä (55 328), Mikkeli (24 410), Varkaus (24 373) and Kuopio (55 067) are some of the many important urban centers located within the influence area of the road.

The influence areas are shown in more detail in Table 1 (p. 11).

2.2 Population

The population and the growth of population in the communes within the influence area of the Tattariharju-Järvenpää Road are shown in Table 1 (p. 11) and in Figure 3 (p. 7). The population of the influence area at the end of 1967 was 35 per cent of the population of the whole country.

The communes of the Helsinki Area and the town of Lahti show a very strong growth of population. The number of inhabitants in the communes of the roadside area is also growing, whereas the commune of Mäntsälä as well as several of the communes of the Lahti Area are characterized by a decreasing number of inhabitants - a feature typical of rural communes in Finland.

The growth of population in the Lahti Area and in the roadside area has so far been larger than estimated and the forecast may prove too cautious in these areas.

2.3 Automobile Stock

The automobile stock and the automobile densities of the influence areas of the Tattariharju-Järvenpää Road at the end of 1967 are given in Table 1 (p. 11). The automobile stock of the influence area was 35 per cent of the automobile stock of the whole country (same as population in 1967).

The level of motorization of the whole influence area is equal to that of the whole country, 140 automobiles per 1 000 inhabitants. The relatively low level of motorization of the whole influence area is mainly due to the low automobile densities of the Northern Area, only 114 automobiles per 1 000 inhabitants. On the other hand, Helsinki and its surroundings form the most motorized region of the whole country.

The development and forecast of the passenger car stock of the influence areas have been given in Figure 4 (p. 8). Attention is attached particularly to the forecasted very large growth of the roadside area. The passenger car stock would grow 3.09-fold by 1980 and 4.81 -fold by 1990. The forecast of the passenger car stock of the roadside area and the Lahti Area can be assumed too cautious because of the pessimistic population forecast of these areas.

2.4 Economic Activities

The size and structure of industrial activities in the communes of the influence area of the Tattariharju-Järvenpää Road are given in Figure 5 (p. 9). The dominant position of Helsinki, followed by Lahti, is completely distinct. Even the other communes shown in the Figure are relatively highly industrialized and the structure of industrial activities is quite versatile.

The typical features of industry of various influence areas and their communes in 1966 are given in Table 1 (p. 11). The gross value of production of industry in the whole influence area was 31 per cent, the value added 35 per cent and the number of industrial employees 36 per cent of the figures for the whole country (the share of population in 1967 was 35 %).

The proportion of people employed in industry to the number of inhabitants is approximately the same as in the whole country. There are, however, many highly industrialized communes within the influence area such as Helsinki (143 employees per 1 000 inhabitants), Kerava (136) and Lahti (152). The communes with the highest level of industrialization in the Northern Area are Heinola (212), Varkaus (177) and Jyväskylä (149).

The development of the gross value of industrial production and the number of persons employed in industrial activities in 1958-66 are given in Figure 6 (p. 10). Attention is attached to the large growth of the roadside area in particular but also to the expansion of the Lahti Area.

Figure 2

INFLUENCE AREAS OF THE ROAD TATTARIHARJU - JÄRVENPÄÄ

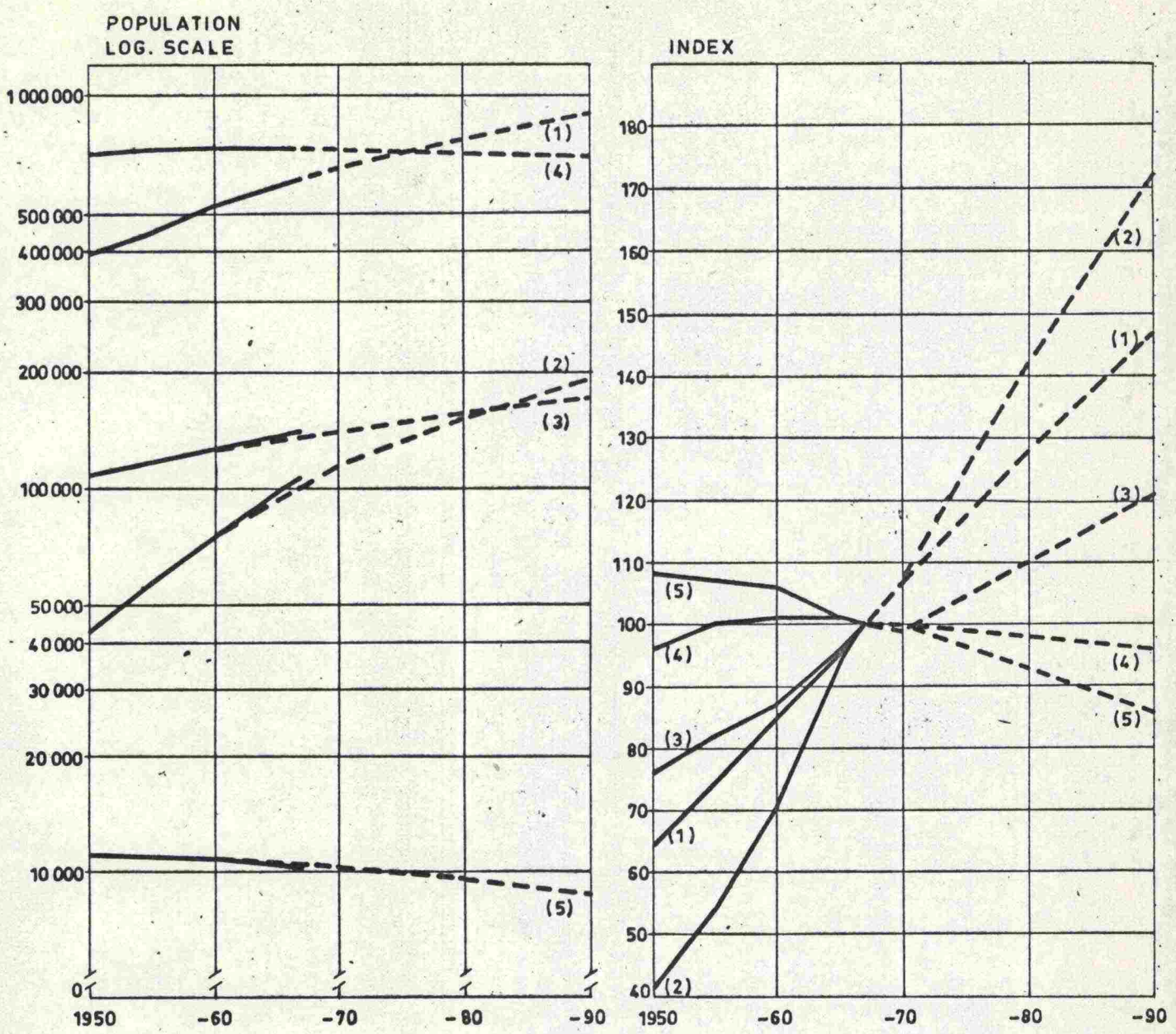
1 : 750 000

I HELSINKI area
II Roadside area
III Mäntsälä
IV LAHTI area
V Northern area


HELSINKI
HELSINGFORS
Leningrad
Suomenlinna
Sveaborg
Kangasniemi
Haukivuori
Hirvensalmi
Tuukkala
Mäntyharju
Heinola
Lahti
Nastola
Orimattila
Hollola
Asikkala
Padasjoki
Luopioinen
Kuhmoinen
Sysmä
Pertunmaa
Kouvola
Kuusankoski
Valkeala
Jaala
Voikkaa
Iitti
Elimäki
Anjala
Inkeroinen
Myllykoski
Kymi
Kotka
Kuhmalahti
Rühimäki
Hyvinkää
Mäntsälä
Järvenpää
Nurmijärvi
Tuusula
Pornainen
Borgå
Porvoo
Loviisa
Lovisa
Hamina
Karhula
Vehkalahti
Ruotsinpyhtää
Strömfors
Liljendal
Myrskylä
Lapinjärvi
Artjärvi
Sipoo
Sibbo
Kerava
Tikkurila
Helsinki-Vantaa
Espoo
Esbo
Tapiola
Kauniainen
Grankulla
Kyrkslätt
Kirkkonummi
Santahamina
Pellinge
Haapasaari
Kabböle
Hindersby
Lappträsk
Lindkoski
Ruotsinkylä
Kuninkaankylä
Pukkila
Myrskylä
Porlammi
Lapinjärvi
Lapptträsk
Backböle
Eskilsom
Ovitsböle
Hardom
Gammelby
Sarvlax
Pyttis
Kymi
Summa
Hillo
Mäntlax
Siltakylä
Tavastila
Hurtaksela
Ummeljoki
Keltakangas
Haapala
Lankila
Kaipiainen
Saaramaa
Enäjärvi
Kaunuskoski
Kausala
Kuivanto
Perheniemi
Sääskjärvi
Haapa-Kimola
Koria
Takamaa
Värälä
Loytty
Rautakorpi
Savero
Harvelä
Ahvio
Juurikorpi
Reitkalli
Husula
Metsäkylä
Paijärvi
Kymmene
Kymi
Kymmene
Kymmene
Kymmene

FIGURE 3

POPULATION DEVELOPMENT AND FORECASTS WITHIN THE INFLUENCE AREAS OF THE ROAD TATTARIHARJU - JÄRVENPÄÄ IN 1950 - 1990 [1]

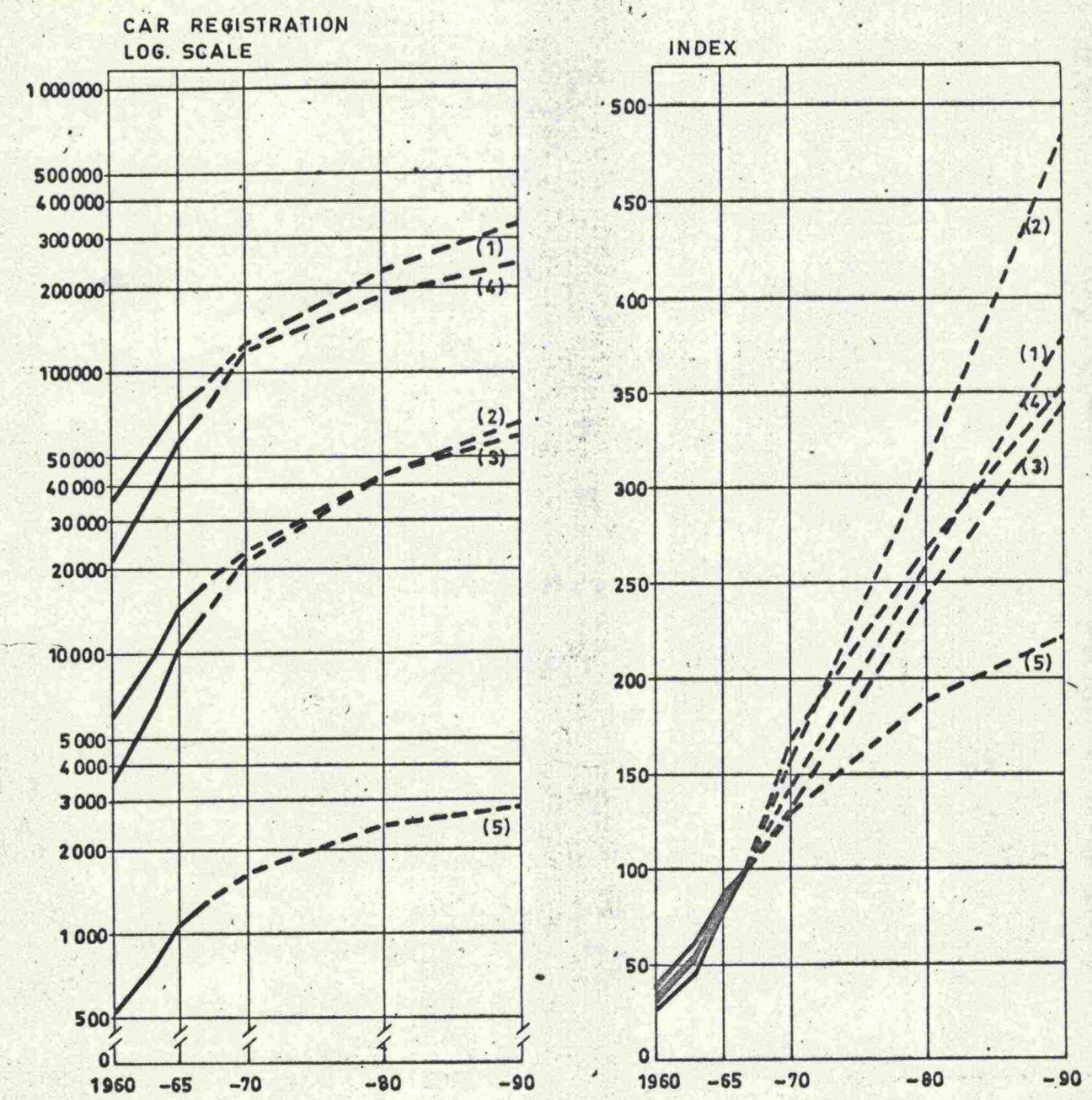


INFLUENCE AREA (1967 = 100)	1950	1955	1960	1965	1967	1970	1980	1990
(1) HELSINKI area	397 086 (64)	455 291 (74)	524 332 (85)	588 334 (95)	617 541 (100)	658 658 (107)	793 405 (142)	909 170 (172)
(2) Roadside area	42 507 (41)	56 606 (54)	74 860 (71)	98 680 (94)	104 739 (100)	112 593 (107)	148 260 (142)	180 232 (172)
(3) LAHTI area	107 935 (76)	116 162 (82)	123 161 (87)	136 186 (96)	141 706 (100)	139 943 (99)	156553 (110)	171 027 (121)
(4) Northern area	711 553 (96)	738557 (100)	748 601 (101)	745 246 (101)	740 635 (100)	741 193 (100)	724812 (98)	708 867 (96)
(5) Mäntsälä	11 169 (108)	11073 (107)	10 903 (106)	10 416 (101)	10 334 (100)	10 333 (100)	9 615 (93)	8 843 (86)

1. STATISTICAL YEARBOOK AND POPULATION FORECAST OF NPO

FIGURE 4

CAR REGISTRATION DEVELOPMENT AND FORECASTS WITHIN THE INFLUENCE AREAS OF THE ROAD TATTARIHARJU - JÄRVENPÄÄ IN 1960 - 1990 [1]

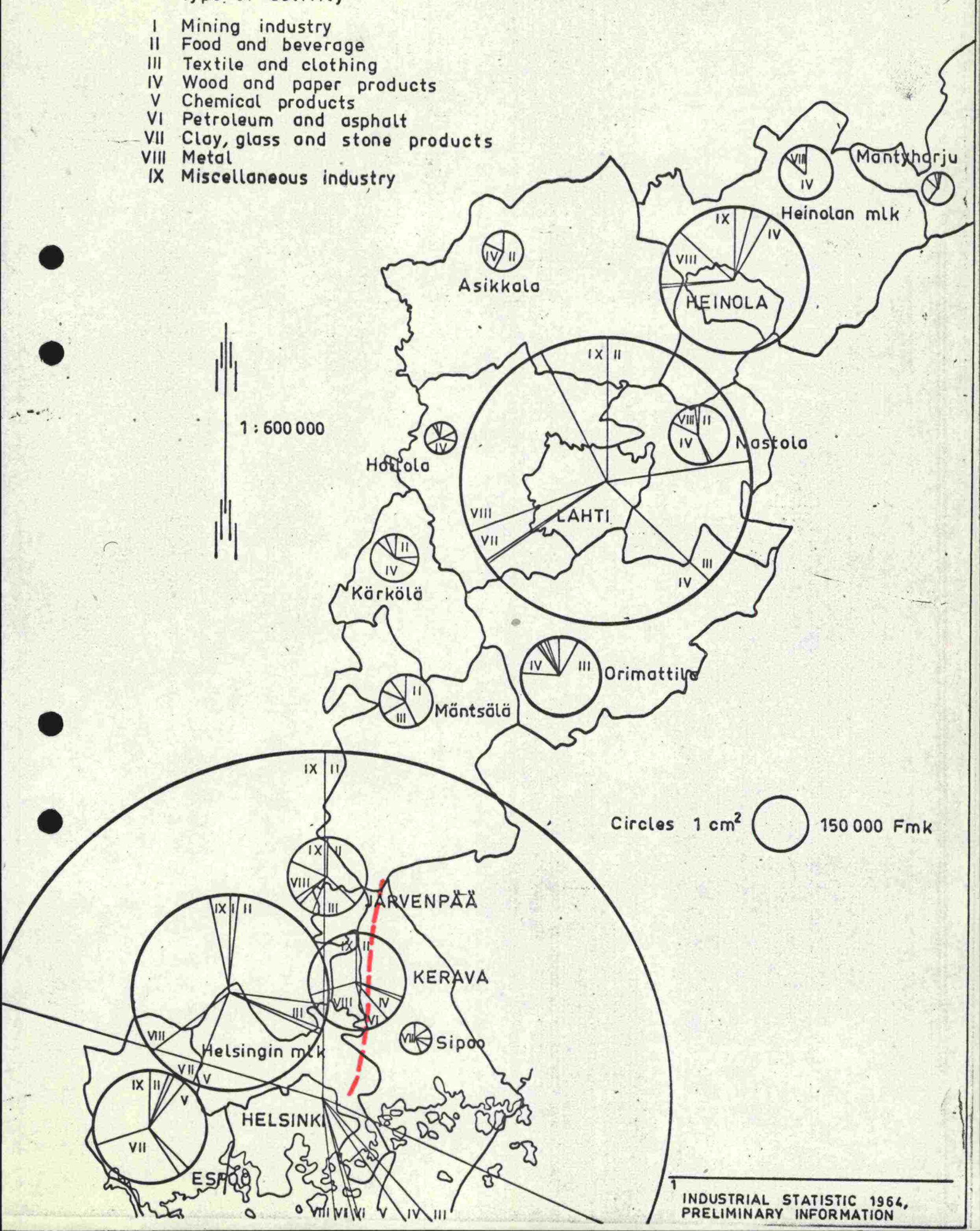


INFLUENCE AREA (1967 = 100)	1960	1963	1965	1967	1970	1980	1990
(1) HELSINKI area	32368 (37)	52655 (60)	73641 (83)	88194 (100)	125150 (142)	226120 (256)	331 850 (376)
(2) Roadside area	3546 (26)	6209 (45)	10408 (76)	13680 (100)	21 390 (156)	42 250 (309)	65790 (481)
(3) LAHTI area	5894 (34)	9 572 (55)	14 558 (83)	17 476 (100)	23 000 (132)	42 250 (242)	59 860 (343)
(4) Northern area	21 283 (30)	36 685 (52)	57 224 (81)	70 294 (100)	117 230 (167)	186 640 (266)	246 540 (351)
(5) Mäntsälä	501 (39)	785 (61)	1 096 (86)	1 281 (100)	1650 (129)	2400 (187)	2 850 (222)

1 AUTOMOBILES AND HIGHWAYS. THE FORECAST IS MADE IN TVH

Figure 5

THE STRUCTURE OF INDUSTRIAL ACTIVITIES ACCORDING TO THE GROSS VALUE OF PRODUCTION WITHIN THE INFLUENCE AREA OF THE ROAD TATTARIHARJU - JÄRVENPÄÄ [1]

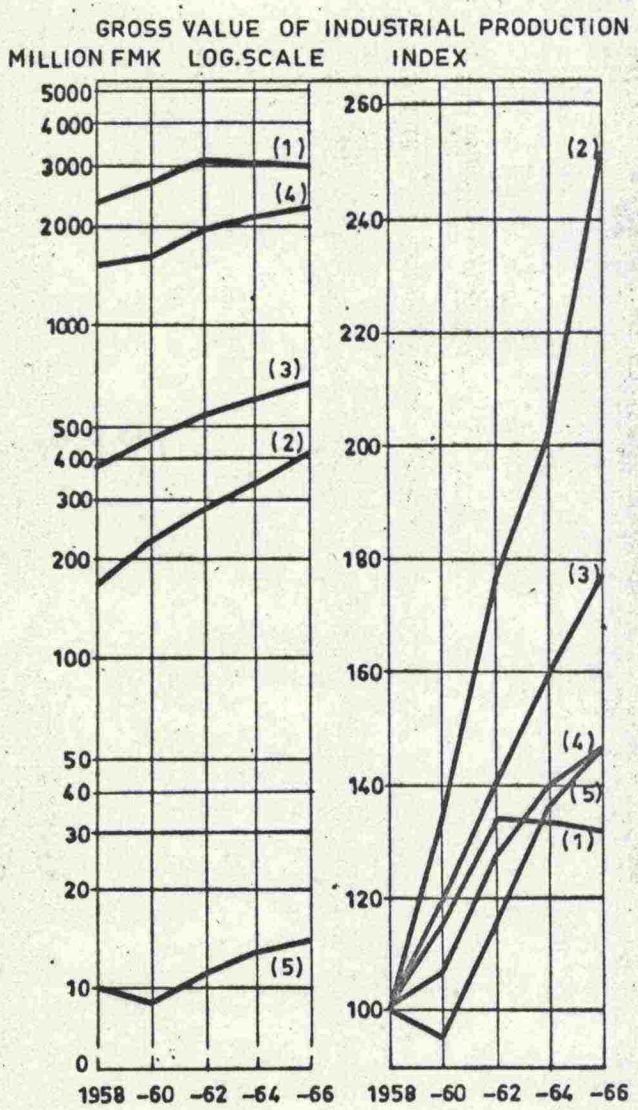


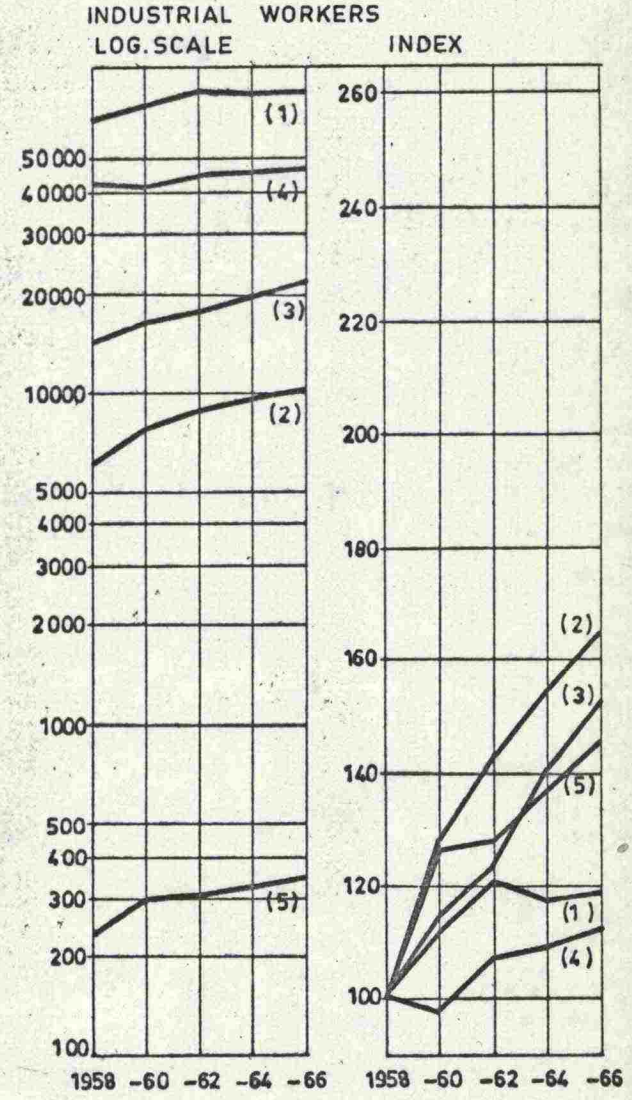
[1] INDUSTRIAL STATISTIC 1964, PRELIMINARY INFORMATION

FIGURE 6

INDUSTRIAL DEVELOPMENT WITHIN THE INFLUENCE AREAS OF THE ROAD TATTARIHARJU - JÄRVENPÄÄ IN 1958 - 1966 [1]

THE SERIES OF THE GROSS VALUE OF PRODUCTION ARE EXPRESSED IN MONEY OF 1966





INFLUENCE AREA (1958=100)	GROSS VALUE OF INDUSTRIAL PRODUCTION MILLION FMK					INDUSTRIAL WORKERS				
	1958	1960	1962	1964	1966	1958	1960	1962	1964	1966
(1) HELSINKI area	2313 (100)	2687 (116)	3111 (135)	3101 (134)	3057 (132)	65 370 (100)	73092 (112)	79182 (121)	77286 (118)	78102 (119)
(2) Roadside area	167 (100)	226 (135)	298 (178)	338 (202)	421 (252)	6 198 (100)	7 961 (128)	8 837 (143)	9 584 (155)	10232 (165)
(3) LAHTI area	384 (100)	462 (120)	540 (141)	616 (160)	678 (177)	14 082 (100)	16 203 (115)	17511 (124)	19 899 (141)	21589 (153)
(4) Northern area	1520 (100)	1626 (107)	1947 (128)	2124 (140)	2235 (147)	41948 (100)	41170 (98)	44874 (107)	45 599 (109)	47151 (112)
(5) Mäntsälä	9.5 (100)	9 (95)	11 (116)	13 (137)	14 (147)	237 (100)	300 (127)	304 (128)	325 (137)	345 (146)

1 INDUSTRIAL STATISTICS. DEFLATION BY THE PRICE INDEX OF DOMESTIC INDUSTRIAL PRODUCTION

Table 1

POPULATION AND VEHICLE REGISTRATION 31.12.1967 AND INDUSTRY IN 1966 WITHIN THE INFLUENCE AREA OF THE ROAD TATTARIHARJU-JÄRVENPÄÄ [1]

Commune and area	Share of the traffic on the road [2] %	Population		Vehicle registration 31.12.1967						Industry in 1966							
				Number			Density/1000 inhabitants				Personnel			Gross value of production 1 000 Fmk		Value added 1 000 Fmk	
		Number 31.12. 1967	Density /km^2	Cars	Others	Total	Cars	Others	Total	Establishments	Average number	/establishment	/1000 inhabitants	Volume	/establishment	Volume	/worker
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
HELSINKI	40.9	527 478	2 982	75 714	14 364	90 078	144	27	171	1 015	75 373	74	143	2946 641	2 903	1 277 000	17
ESPOO	2.2	90 063	286	12 480	1 262	13 742	139	14	153	64	2 729	43	30	110 245	1 723	59 477	22
Total HELSINKI area	43.1	617 541	1 256	88 194	15 626	103 820	143	25	168	1 079	78 102	72	126	3056 886	2 833	1336 477	17
KERAVA	8.4	12 831	421	1 661	254	1 915	129	20	149	22	1 747	79	136	60 254	2 739	26 299	15
Helsingin mlk	7.9	65 202	272	8 414	1 095	9 509	129	17	146	102	7 018	69	108	316 094	3 099	127 505	18
JÄRVENPÄÄ	4.4	15 048	363	2 018	305	2 323	134	20	154	42	1 276	30	85	38 782	923	18 109	14
Sipoo	3.2	11 658	32	1 587	363	1 950	136	31	167	12	191	16	16	6 277	523	2 554	13
Total roadside area	23.9	104 739	156	13 680	2 017	15 697	131	19	150	178	10 232	57	98	421 407	2 367	174 467	17
LAHTI area	14.1	141 706	40	17 476	3 298	20 774	123	23	146	301	21 589	72	152	677 607	2 251	300 984	14
Mikkelin lääni	4.3	226 890	14	21 983	4 240	26 223	97	19	116	281	12 145	43	54	507 490	1 806	175 376	14
Keski-Suomen lääni	2.9	247 841	16	25 854	5 079	30 933	104	21	125	297	20 173	68	81	974 063	3 280	316 645	16
Kuopion lääni	1.7	265 904	16	22 457	5 024	27 481	84	19	103	287	14 833	52	56	753 196	2 624	235 285	16
Total Northern area	8.9	740 635	15	70 294	14 343	84 637	95	19	114	865	47 151	55	64	2234 749	2 584	727 306	15
Mäntsälä	5.6	10 334	18	1 281	359	1 640	124	35	159	18	345	19	33	14 221	790	4 557	13
Whole influence area	95.6	1 614 955	30	190 925	35 643	226 568	118	22	140	2 441	157 419	64	97	6404 870	2 624	2543 791	16
Whole country		4 676 048	15	551 198	104 559	655 757	118	22	140	7 402	440 349	59	94	20944108	2 830	7272 192	17

[1] Statistical Yearbook, Automobiles and Highways and Industrial statistics.

[2] Shares have been determined according to the traffic flow information of the Helsinki - Metropolitan Transportation study.

3. Road Network

3.1 Existing Road Network

The existing road network and the surfacing types of the most important roads of the surrounding area of the project are given in Figure 7 (p. 13). The most important projects under construction and some planned road sections are given in Figure 8 (p. 14).

The existing main road network of the whole country is shown in Figure 9 (p. 15). The length of dual carriageway roads on January 1, 1969 was as follows:

- motorways	102 km
- other dual carriageway roads	17 "
- total	119 km

3.2 Future Road Networks

According to a preliminary programme concerning the need of road construction in 1969-1980 prepared in the Road Planning Division of the National Board of Public Roads and Waterways, the need of construction required by the capacity problems of main roads would be as follows:

- motorways	466 km
- motor roads	309 "
- other dual carriageway roads	63 "
- total	838 km

The term "motor road" means roads belonging to the operational category of motorways intended for high speed traffic. Motor roads usually are single carriageway roads with complete or partial control of access, which may, when necessary, be widened to motorways.

The location of these projects is given in Figure 10 (p. 16).

The trunk road network planning covering the whole country is proceeding.

Figure 7

PRESENT TRAFFIC NETWORK

1: 750 000

railway
paved road
constructed oil gravel road
unconstructed oil gravel road
other roads gravel

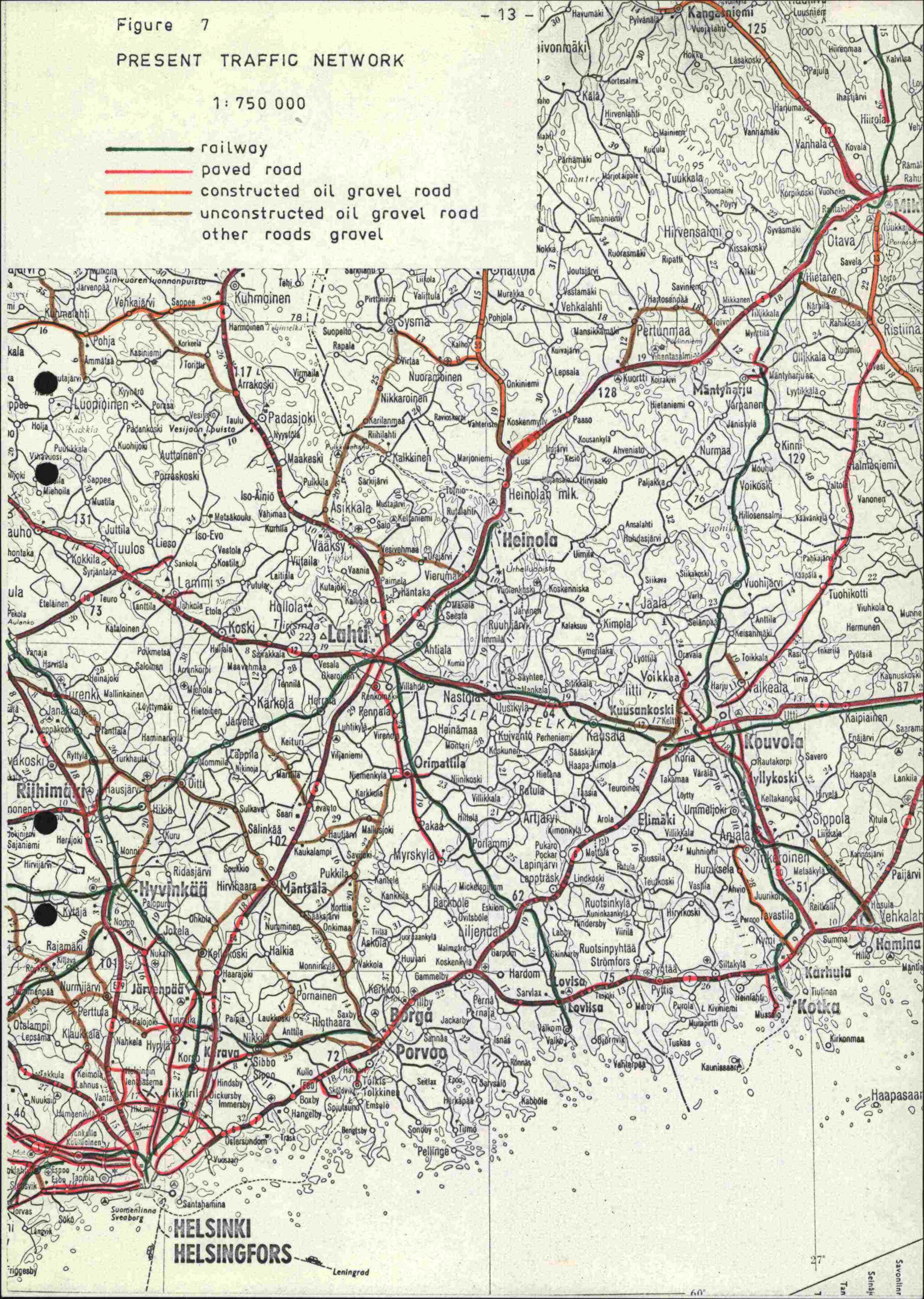

HELSINKI
HELSINGFORS
Leningrad
Kangasniemi
Hirvensalmi
Mäntyharju
Heinola
Lahti
Orimattila
Kouvola
Kuusankoski
Jyväskylä
Hyvinkää
Riihimäki
Järvenpää
Porvoo
Lovisa
Karhula
Kotka
Hamina
Borgå
Mäntsälä
Nastola
Heinolan mlk.
Sysmä
Padasjoki
Asikkala
Hollola
Kärkölä
Elimäki
Artjärvi
Myrskylä
Pukkila
Sibbo
Lohja
Tammisaari
Ekenäs
Hangö
Raseborg
Karis
Inkoo
Kyrkslätt
Esbo
Grankulla
Vanda
Helsingfors
Suomenlinna
Sveaborg
Santahamina
Sköldvik
Tolkkinen
Hindsby
Dickursby
Immersby
Boxby
Hangelby
Spjutsund
Emsalö
Ekenäs
Tenala
Snappertuna
Skogby
Tammisaari
Bromarv
Ingå
Finby
Pojo
Kirkkonummi
Masala
Espoo
Esbo
Jorvas
Sökö
Långvik
Triggesby
Vuosaari
Östersundom
Träsk
Bergtsby
Sondby
Tirmo
Pellinge
Kabböle
Haapasaari
Kirkonmaa
Kaunissaari
Vahterpää
Tuskas
Mussalo
Heinlahti
Pyttis
Marby
Purola
L. Kivimieni
Kivimurtti
Strömfors
Pyytää
Siltakylä
Ruotsinpyhtää
Kuninkaankylä
Lindersby
Viirilä
Ruotsinkylä
Lappträsk
Lindkoski
Teutkoski
Vasilla
Ahvio
Hurtuksela
Juurikorpi
Tavastila
Kymi
Summa
Hillo
Mäntlä
Kuusankoski
Kelttikangas
Loytty
Takamaa
Varala
Koria
Rautakorpi
Savero
Kaipiainen
Saarama
Enäjärvi
Kaunuskoski
Valkeala
Tirva
Harju
Voikkaa
Lyöttilä
Oravala
Toikkala
Rasi
Inkeriä
Pyötsiä
Kymentaka
Sikkala
Sayhtee
Mankala
Kausala
Kuivanto
Perheniemi
Koskunen
Haapa-Kimola
Sääskjärvi
Haapala
Lankila
Kyllykoski
Keltakangas
Hirvelä
Ummeljoki
Villikkala
Liikkala
Sippola
Kitula
Anjala
Kannosjärvi
Paijärvi
Metsäkylä
Reitkalli
Hosula
Vehkalahti
Tiutinen

Figure 8

PLANNED TRAFFIC NETWORK

1:750 000

Main roads

present

under construction

planned

Other roads

under construction

planned

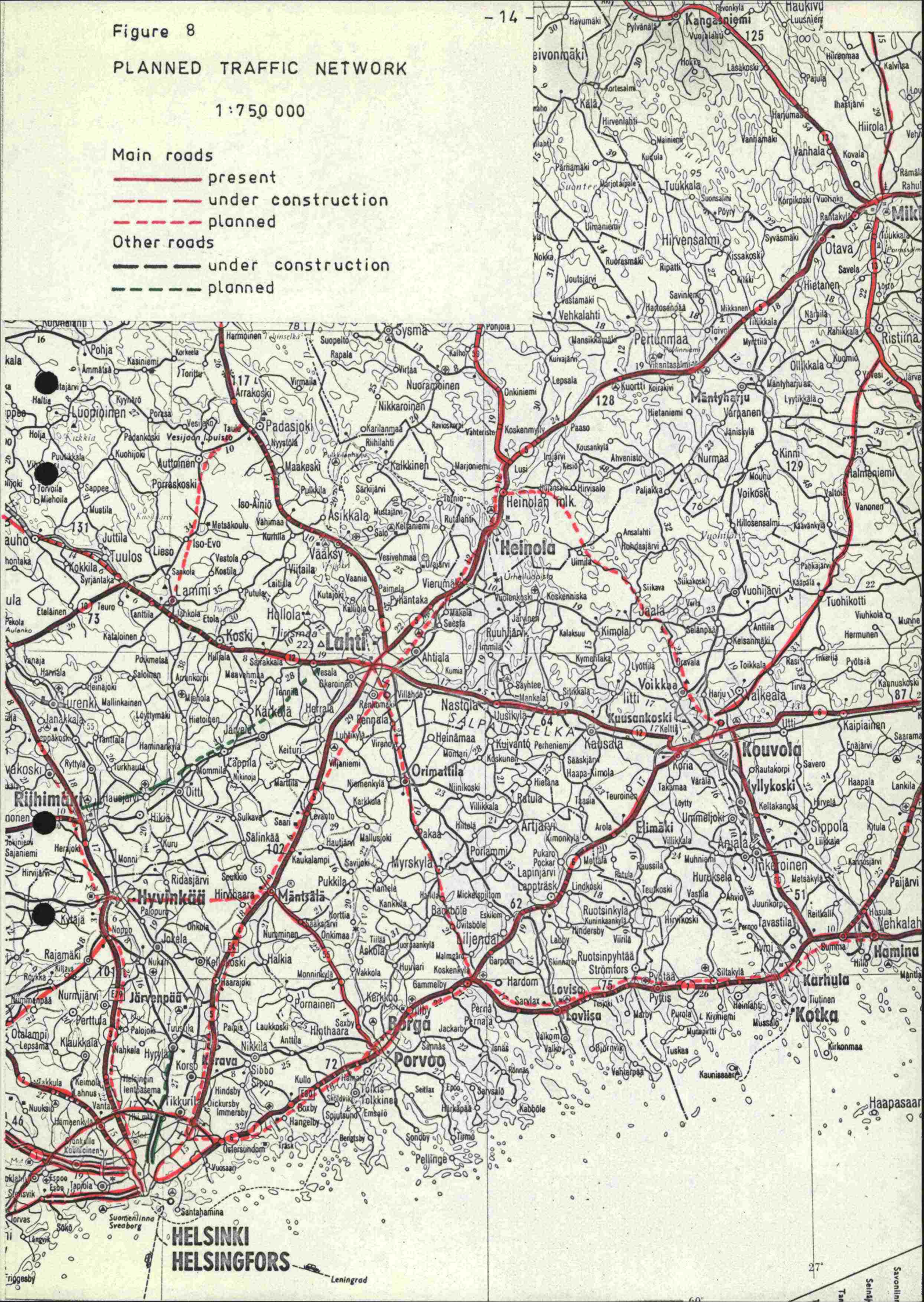


Figure 9

MAIN ROAD NETWORK IN 1969

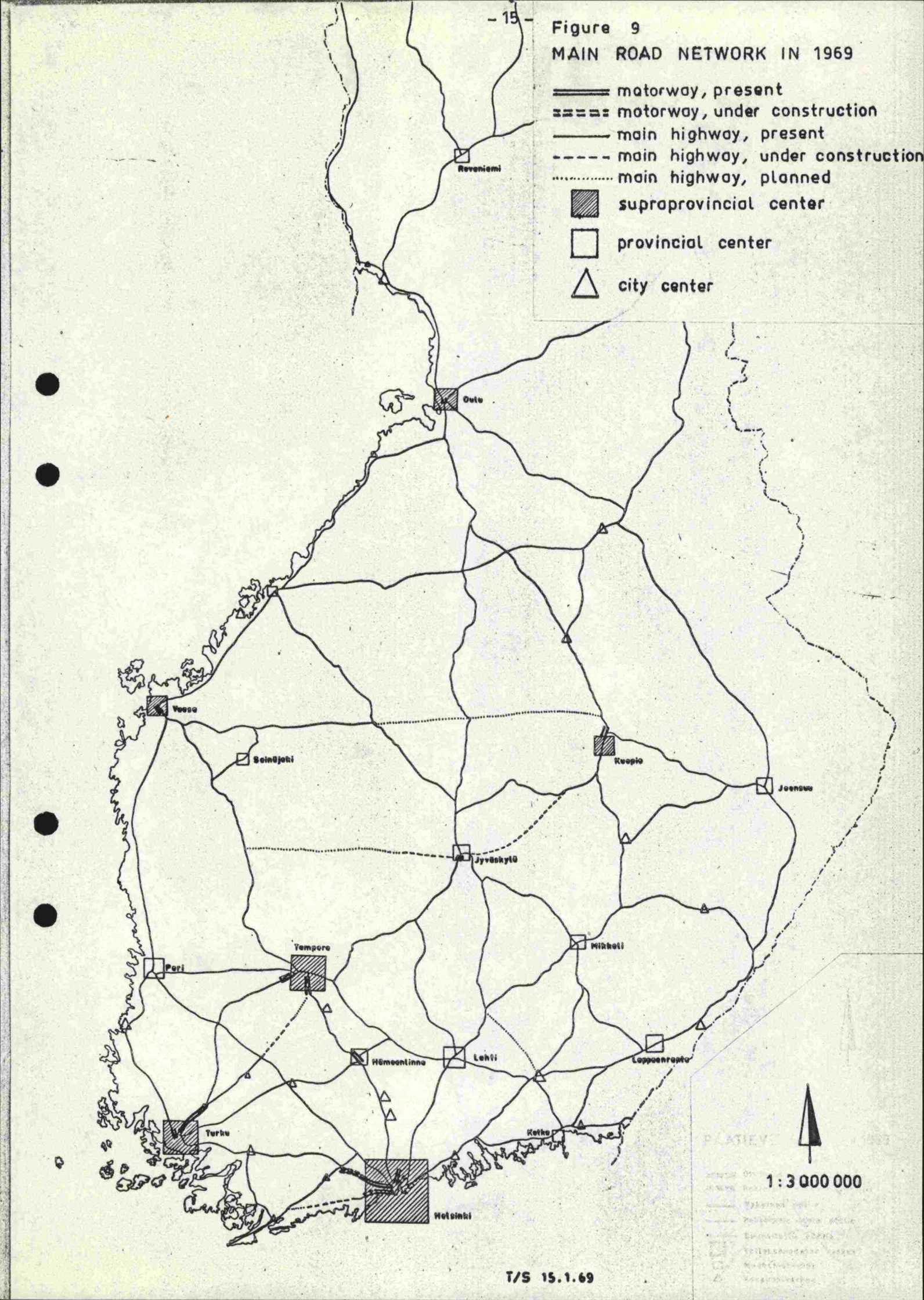


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Figure 10

NEED FOR MOTORWAY CONSTRUCTION IN 1969 - 1980

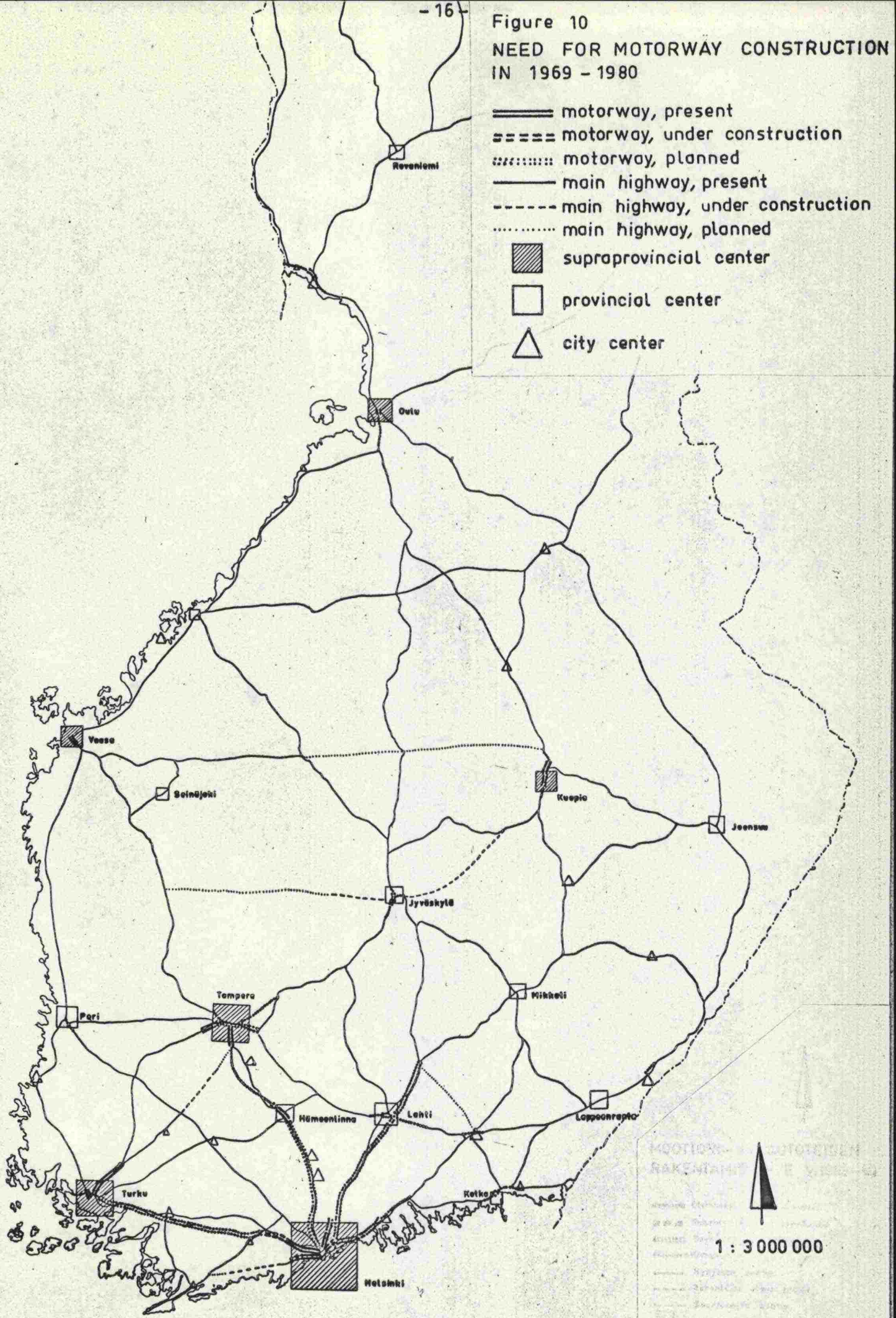

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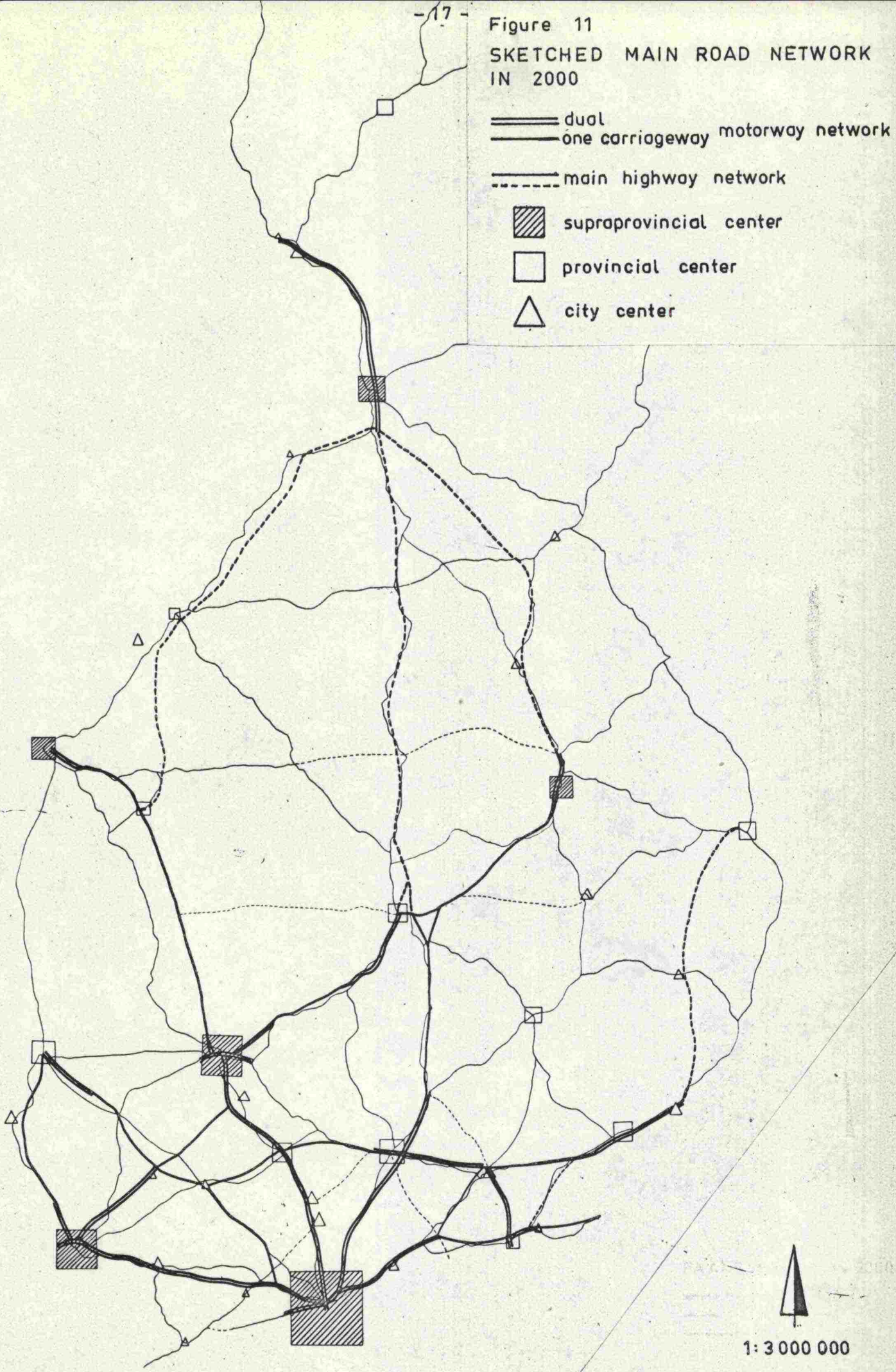
Figure 11

SKETCHED MAIN ROAD NETWORK IN 2000



4. Traffic

4.1 Development and Composition

The development and composition of traffic has been followed on the basis of data from the point 0120 of the control fraffic count located between Kerava and Järvenpää (Figure 12, p. 21). At this point traffic has grown about 3.1 -fold from 1960 to 1968 and about 1.3 -fold from 1965.

The share of heavy traffic (lorries and buses) during the observation period 1960-68 has decreased from 33 per cent to 17 per cent.

Traffic volumes by road section (AADT-65) of Main Roads 4-5 and 5 are given in Figure 13 (p. 22).

4.2 Variations

The variations of traffic are followed by permanent mechanical counts. The mechanical counting point 0102 is located on road section Tattariharju-Järvenpää. The mechanical counting point 0612 on Main Road 5 in the rural commune of Heinola has been selected as the control point. The seasonal fluctuation of traffic at these points is given in Figure 14 (p. 23).

The proportion of the summer average daily traffic to the annual average daily traffic (SADT/AADT) at these points was as follows:

	1966	1967	1968
point 0120	1.27	1.22	1.26
point 0162	1.42	1.42	1.50

The proximity of Helsinki is the cause for the two peaks in the variation curve at point 0120 and is due to decreasing of work trips during the summer vacation season.

Seasonal fluctuations are also shown in Figures 15 and 16 (p. 24 and p. 25).

The distributions of the daily traffic volumes on various days of the week are given in Figures 17 and 18 (p. 26 and p. 27). In order to show the hourly fluctuation, three weeks representing different seasons in 1968 have been selected at point 0120.

The fluctuations are given in Figure 19 (p. 28). The effect of free Saturdays adopted generally in 1967 can be noticed in the distribution of the summer week. The distribution of the highest hourly traffic volumes at points 0120 and 0612 has been examined in Figure 20 (p. 29).

4.3 Goods Traffic

The flow of goods in 1966 was also examined in the national traffic flow study. The results can be converted into the average weekday traffic volume of the year.

The interview spot No. 4 was located at Luhtikylä on Main Road 4-5. On the basis of data from this point the origins and destinations and types of commodities carried at this cross-section could be clarified (Figures 21 and 22, p. 30 and p. 31). The types of goods carried have been divided into two categories, of which the first corresponds roughly to raw materials and semi-products and the second group to final products.

When the distribution of types of commodities by direction of transport is examined, we obtain the following table:

Type of Goods	Direction North %	Direction South %
Industrial raw materials	56	44
Building supplies and machines	55	45
Solid fuels	36	64
Liquid fuels	98	2
Commodity Group 1, Total	63	37
Foodstuffs	65	35
Industrial products	45	55
Piece goods	91	9
Other goods	68	32
Empty	71	29
Commodity Group 2, Total	80	20
Grand Total	72	28

4.4 Traffic Accidents

Traffic accidents on road section Koskela-Mäntsälä in 1967 have been examined in Figure 23 (p. 32). The following Table of traffic accidents in the whole country is given for comparison:

Whole country	Accidents	
	/10^8km driven	/km
Main Roads	116	0.9
Secondary Roads	125	0.4
Total	117	0.6
Motorways		
- Jorvas Motorway	85	3.9
- Tarvo Motorway	54	2.1
- Tuusula Motorway	74	4.6
All Motorways	78	2.4

The spots of accidents are given in Figure 24 (p. 33).

4.5 Traffic Forecast

Numerous regional traffic forecasts have been prepared in various connections during the last few years. Road section Tattariharju-Järvenpää belongs to the road networks examined in these forecasts. A number of forecasts by road sections in the existing road system have also been made. The principal forecasts are shown in Figure 25 (p. 34).

The preparation of a separate forecast for this clarification was not regarded necessary and the Forecast 5 used in the economic justification is based on Forecasts 2 and 3. When the traffic forecast used in final engineering was made, account was also taken of the development implied in the latest prognoses of land use, which effects are not included in other forecasts.

Figure 12

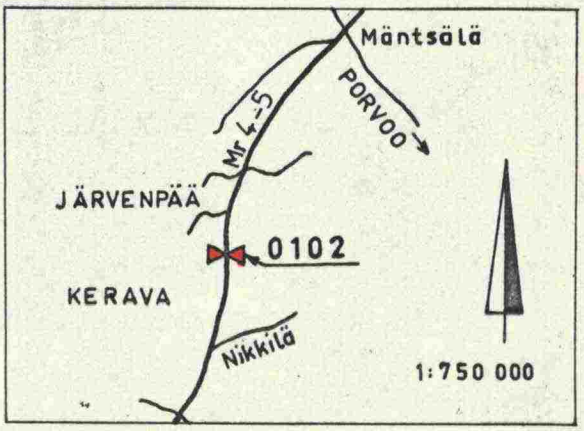
COMPOSITION AND DEVELOPMENT OF TRAFFIC
MAIN ROAD 4–5, point 0102

AADT

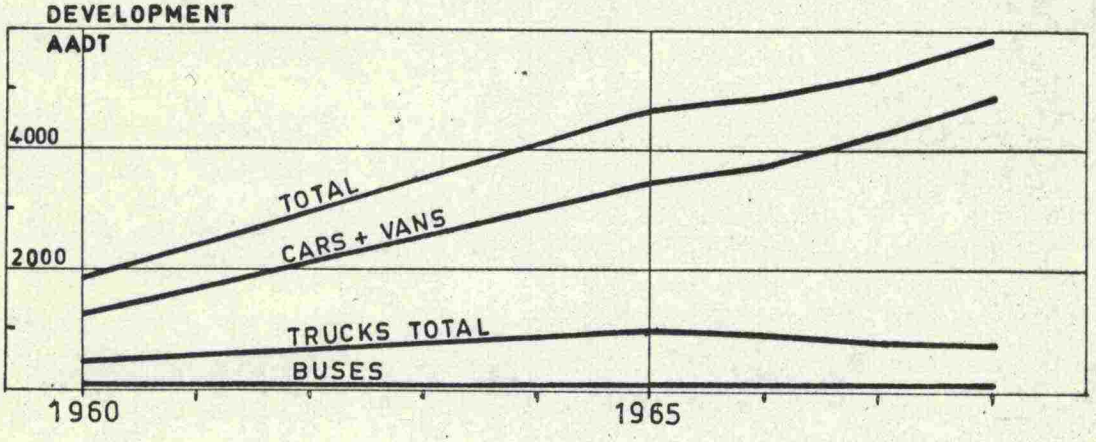
TYPE OF VEHICLE	1960	1965	–66	–67	–68
CARS	1 190	3 308	3 570	4 016	4 620
VANS	82	170	174	243	251
CARS+VANS	1 272	3 478	3 744	4 257	4 871
TRUCKS WITHOUT TRAILER	..	754	602	454	442
OTHER TRUCKS	..	300	388	410	399
TRUCKS TOTAL	507	1 054	990	864	841
BUSES	108	137	139	149	150
TOTAL	1 887	4 669	4 873	5 272	5 862

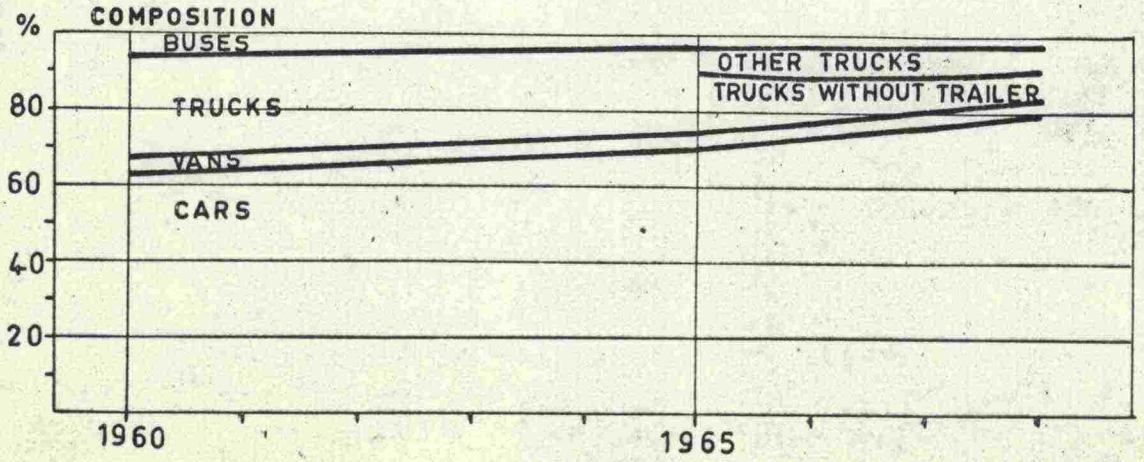
ALL VEHICLES, INDEX

1960	100	
1965	247	100
–66	258	104
–67	279	113
–68	311	126



DEVELOPMENT





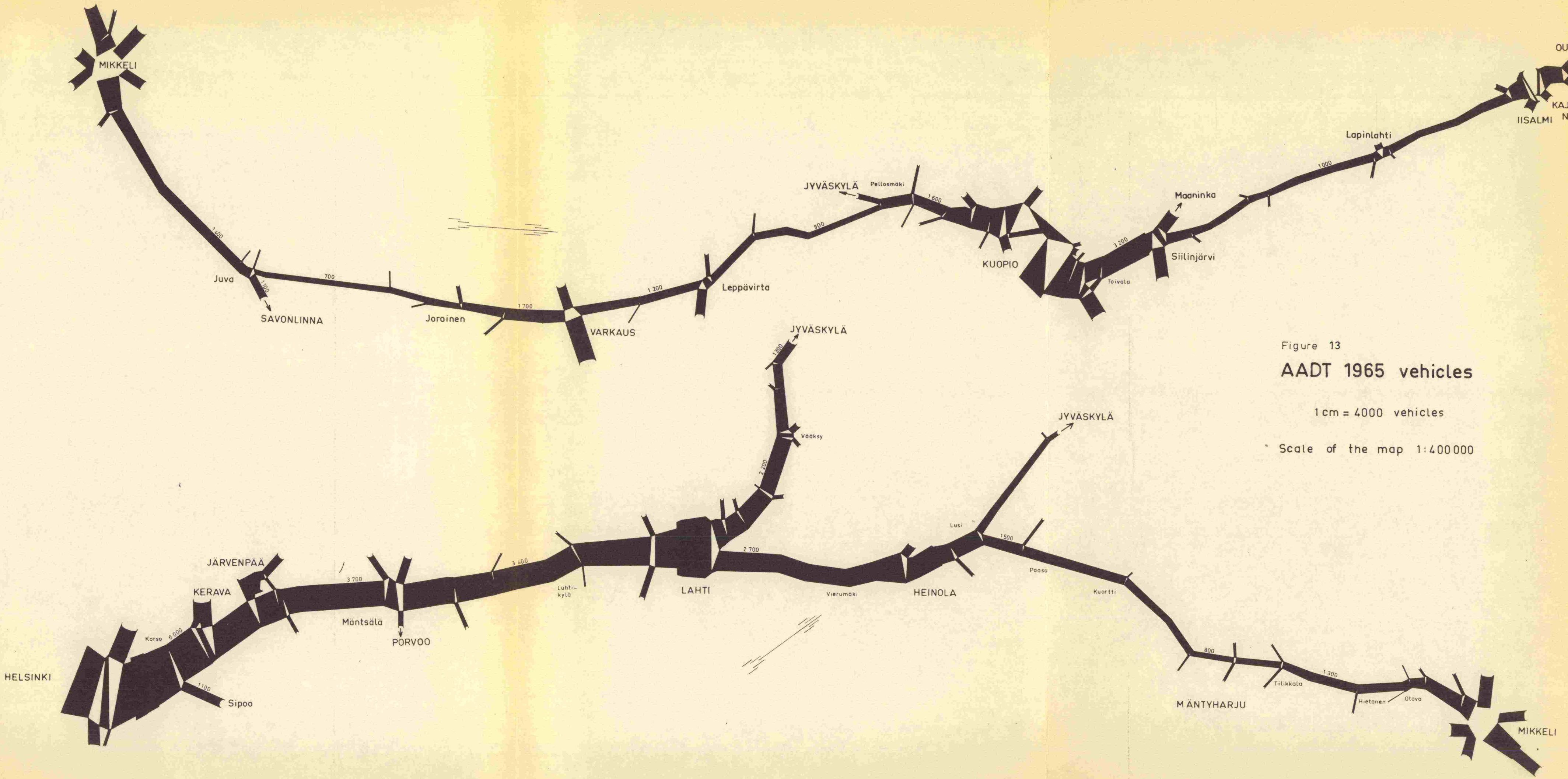


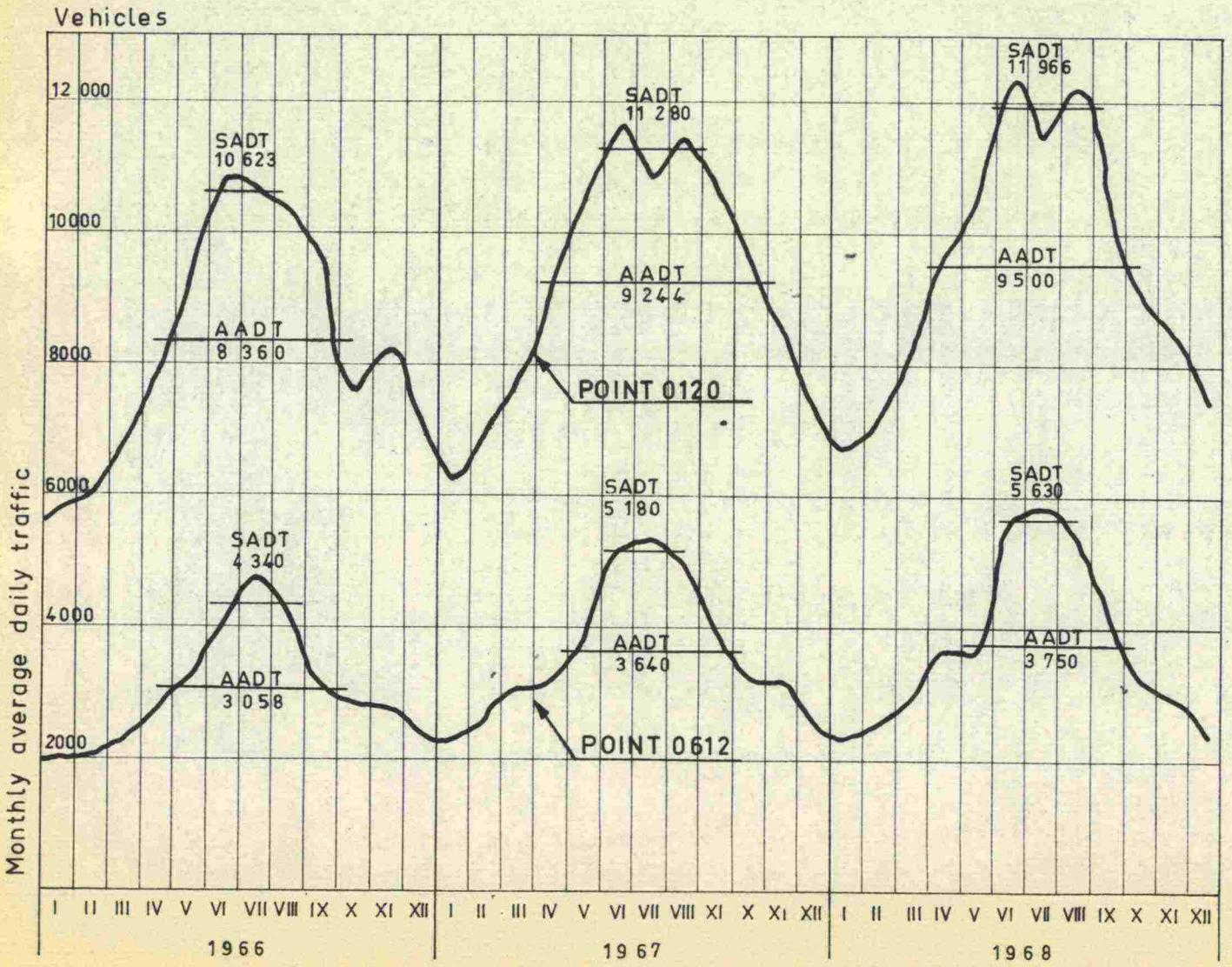
Figure 13

AADT 1965 vehicles

1 cm = 4000 vehicles

Scale of the map 1:400000

Figure 14
SEASONAL VARIATIONS IN 1966 - 68
MAIN ROAD 4 - 5 AND 5



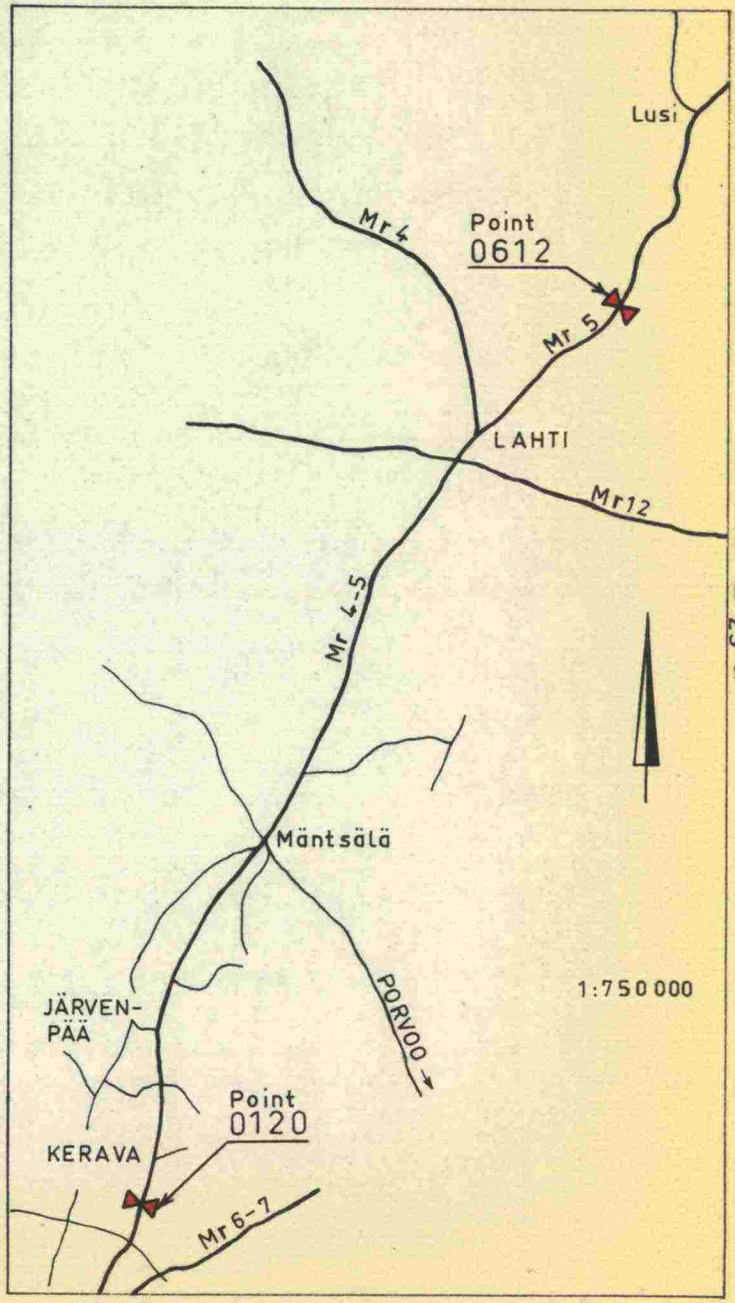


Figure 15
SEASONAL VARIATIONS IN 1966-68
MAIN ROAD 4-5, POINT 0120

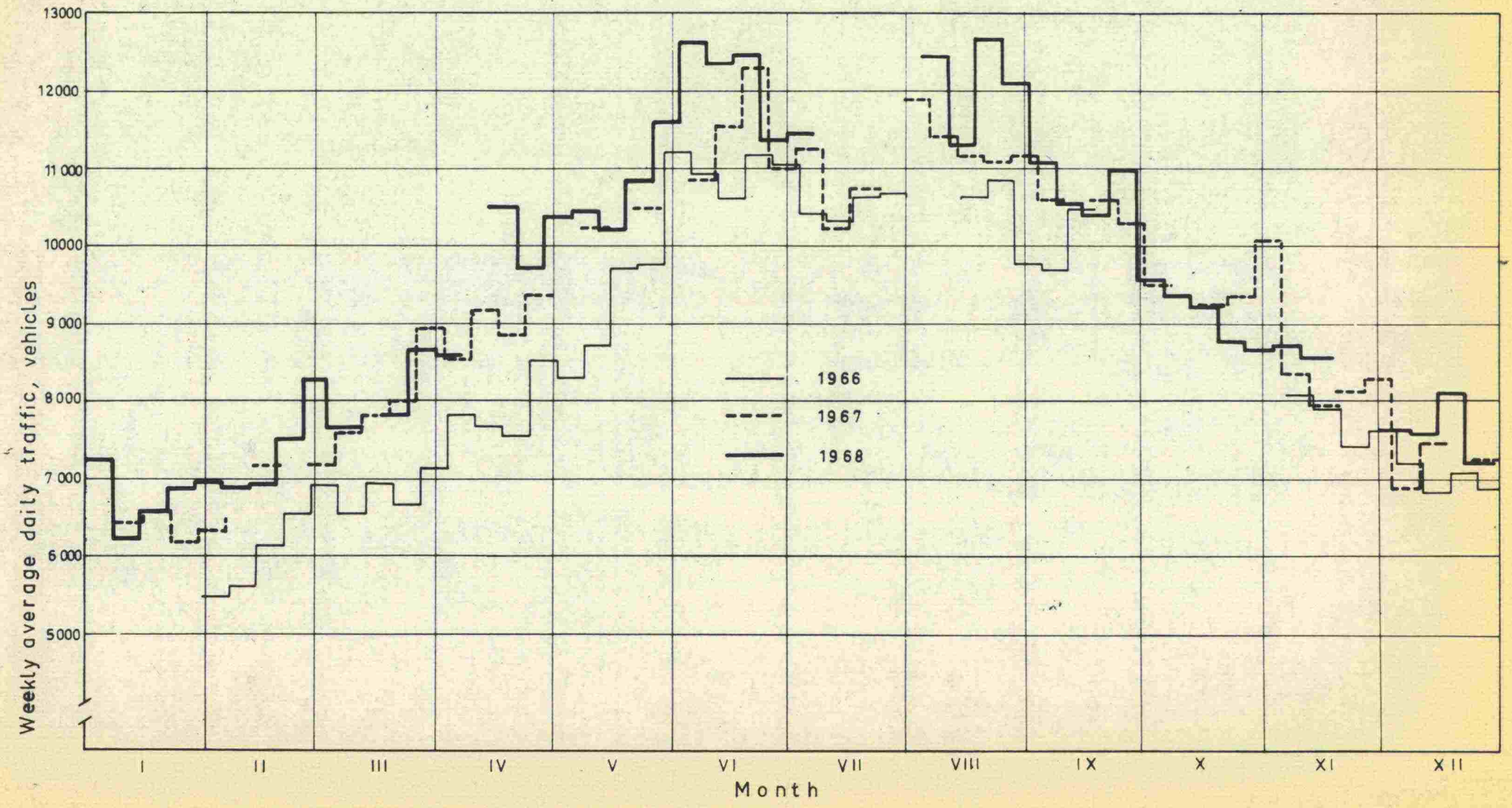


Figure 16

SEASONAL VARIATIONS IN 1967 - 68
MAIN ROAD 4 - 5, POINT 0612

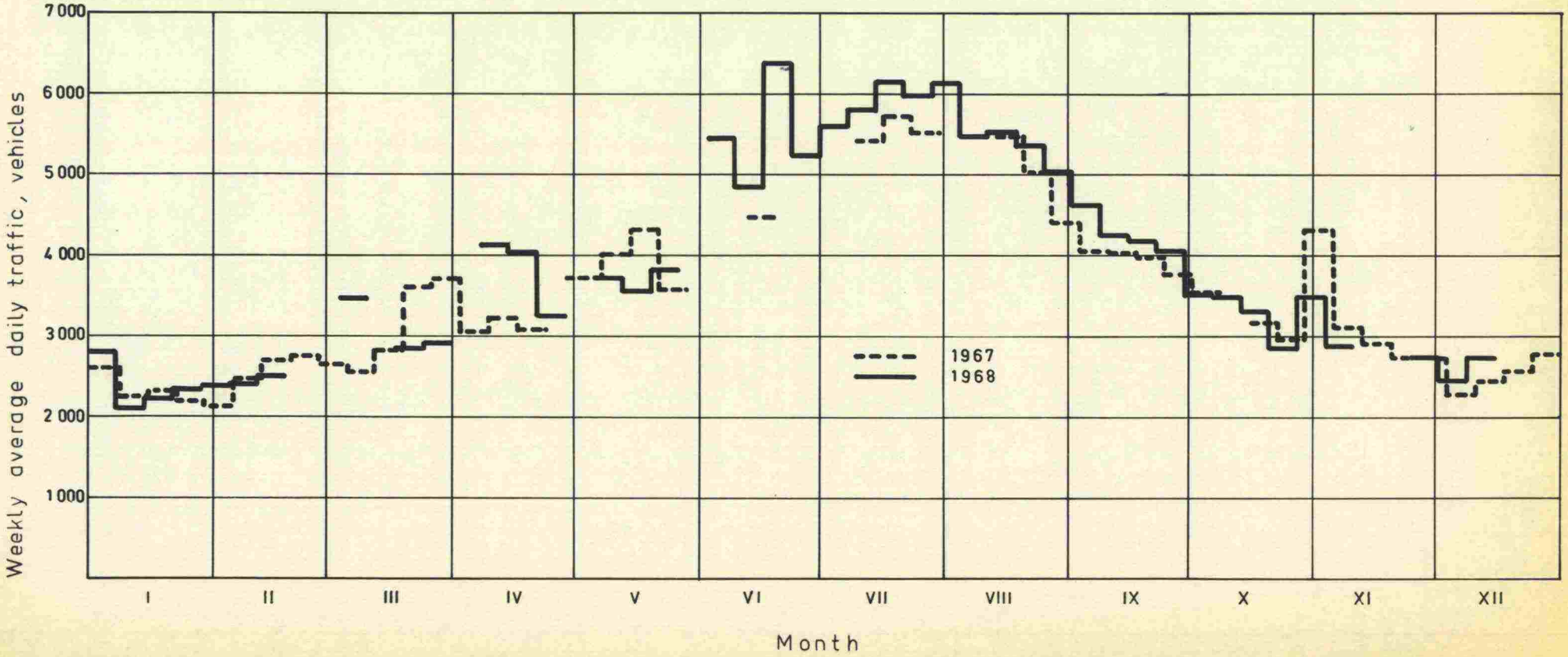
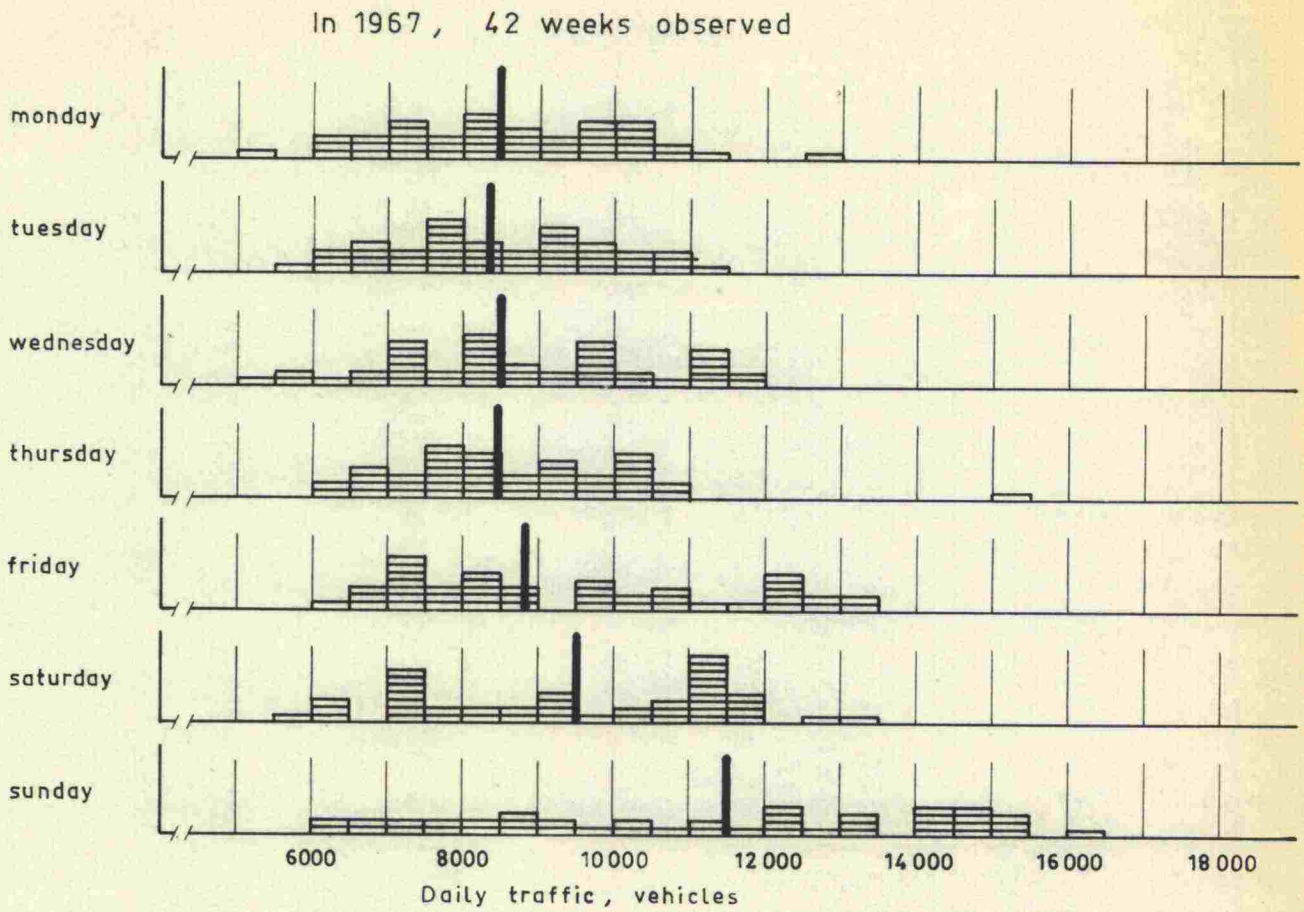


Figure 17

DAY-TO-DAY VARIATIONS IN 1967-68
DISTRIBUTION AND MEDIAN
MAIN ROAD 4-5, POINT 0120



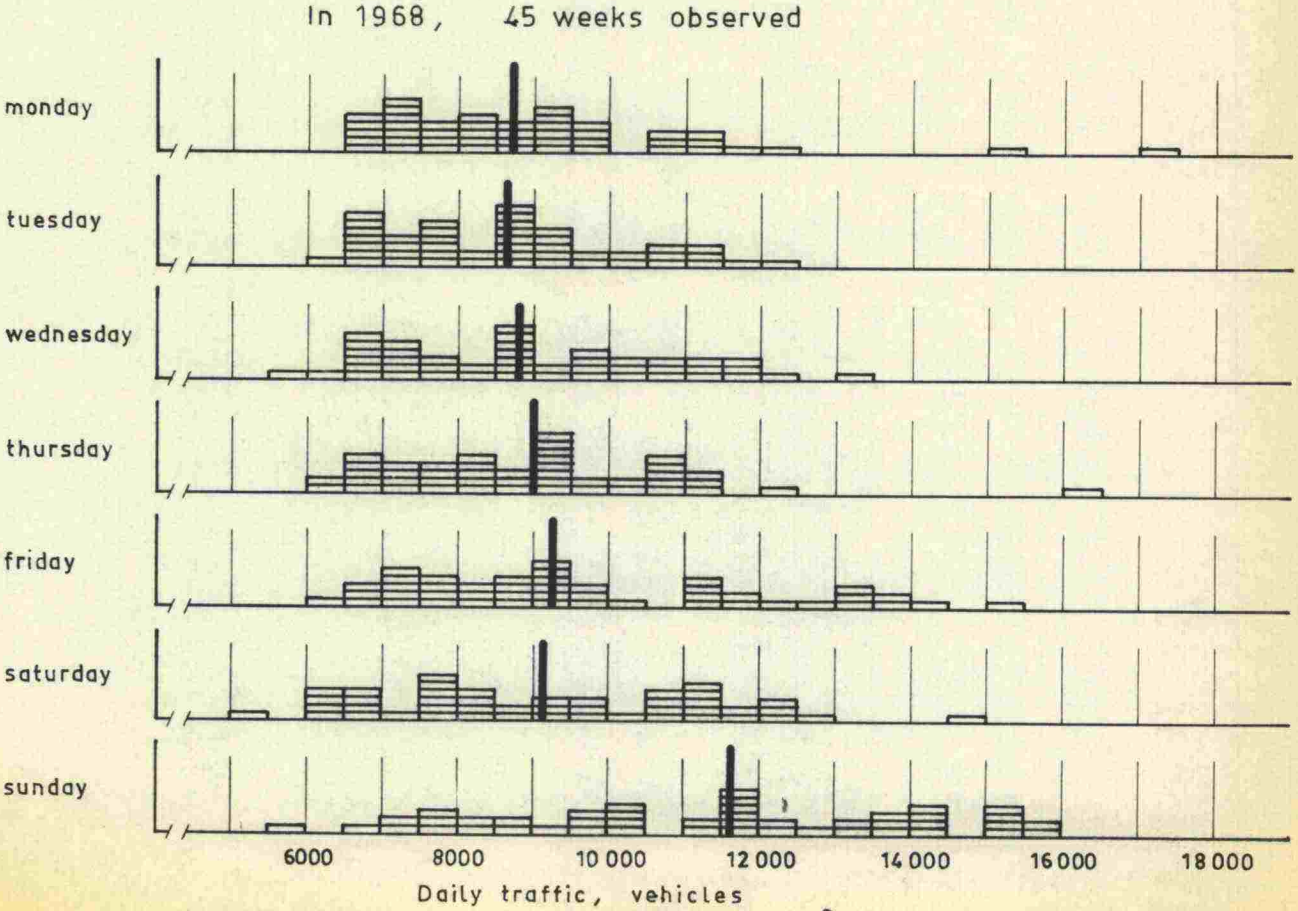
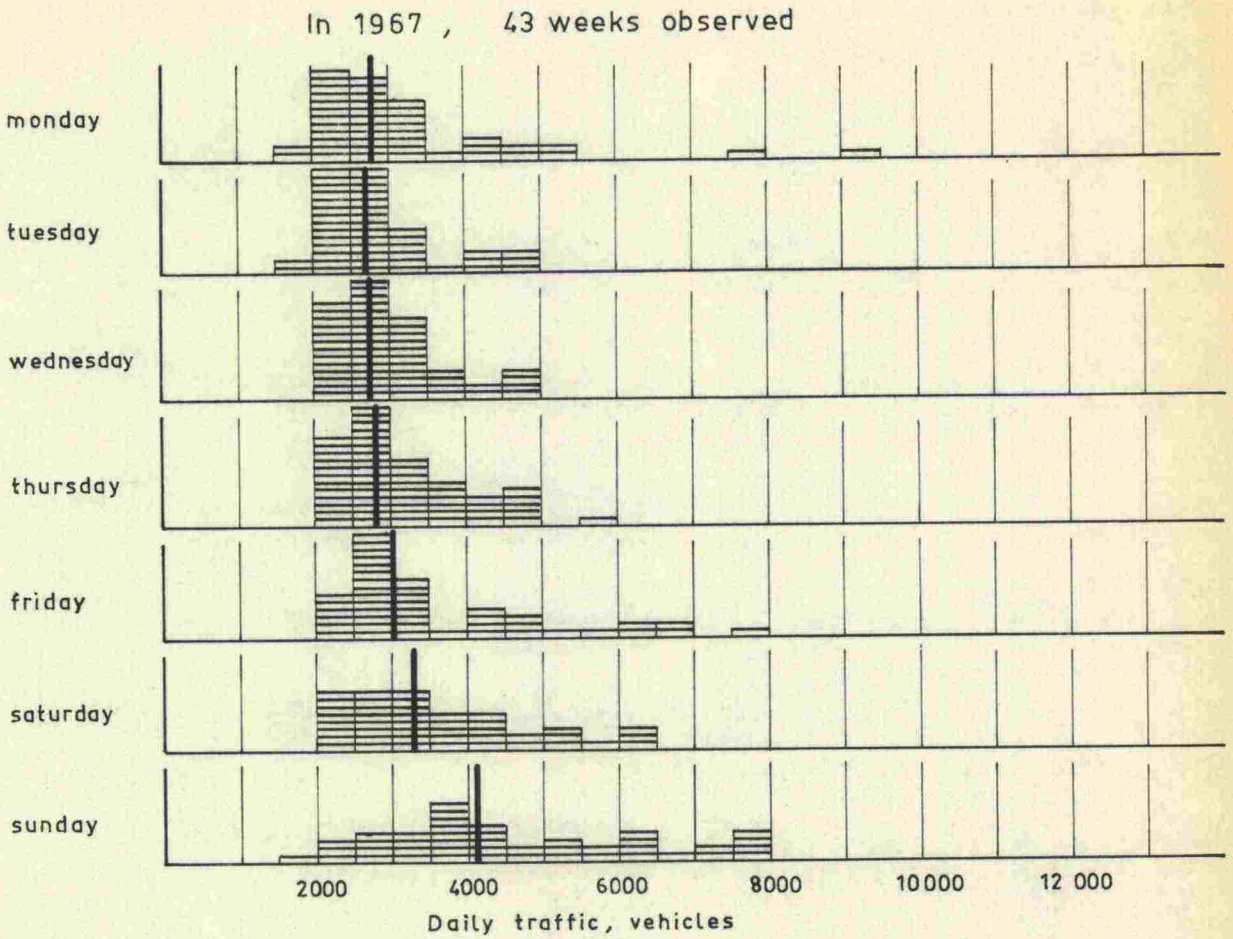


Figure 18

DAY-TO-DAY VARIATIONS IN 1967-68
DISTRIBUTION AND MEDIAN
MAIN ROAD 5, POINT 0612



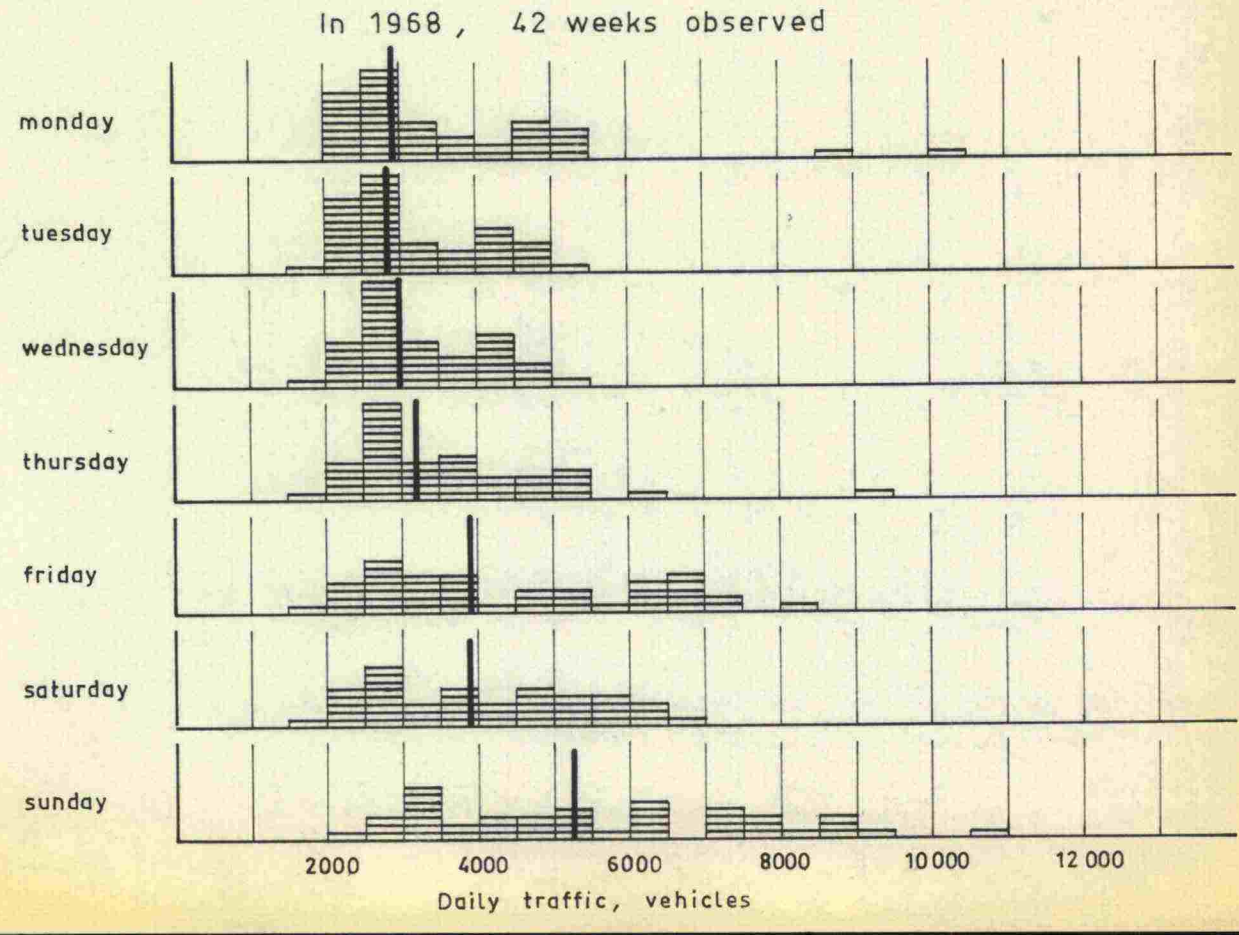
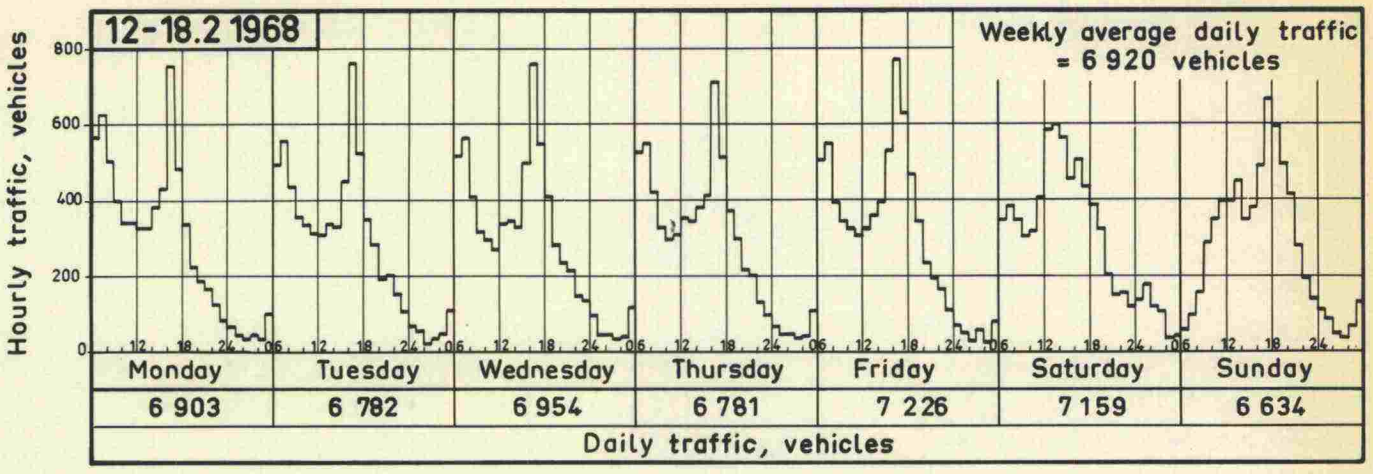


Figure 19

HOURLY VARIATIONS IN 1968
MAIN ROAD 4-5, POINT 0120

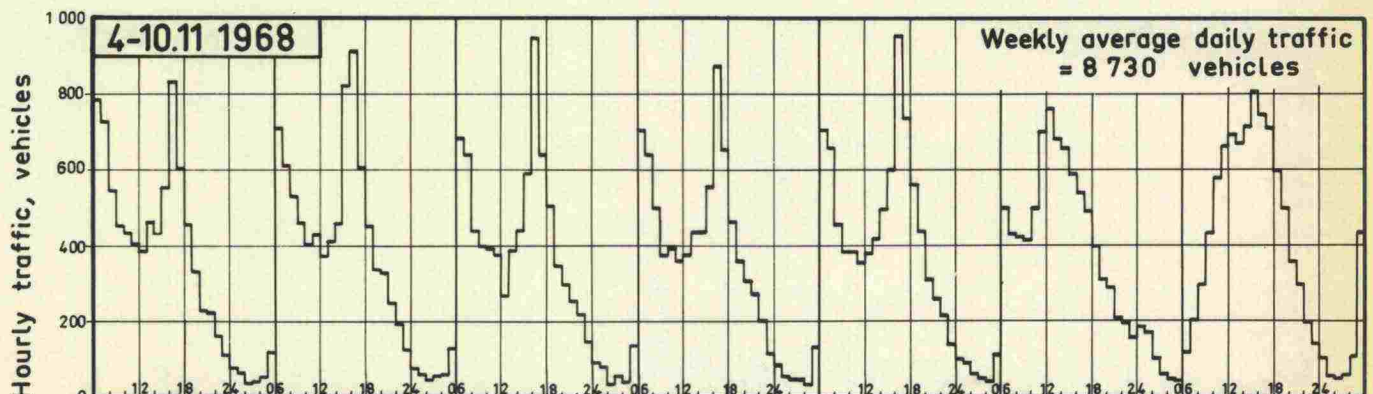


Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
6 903	6 782	6 954	6 781	7 226	7 159	6 634

Daily traffic, vehicles

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
10 930	10 878	11 968	11 380	14 190	12 673	14 542

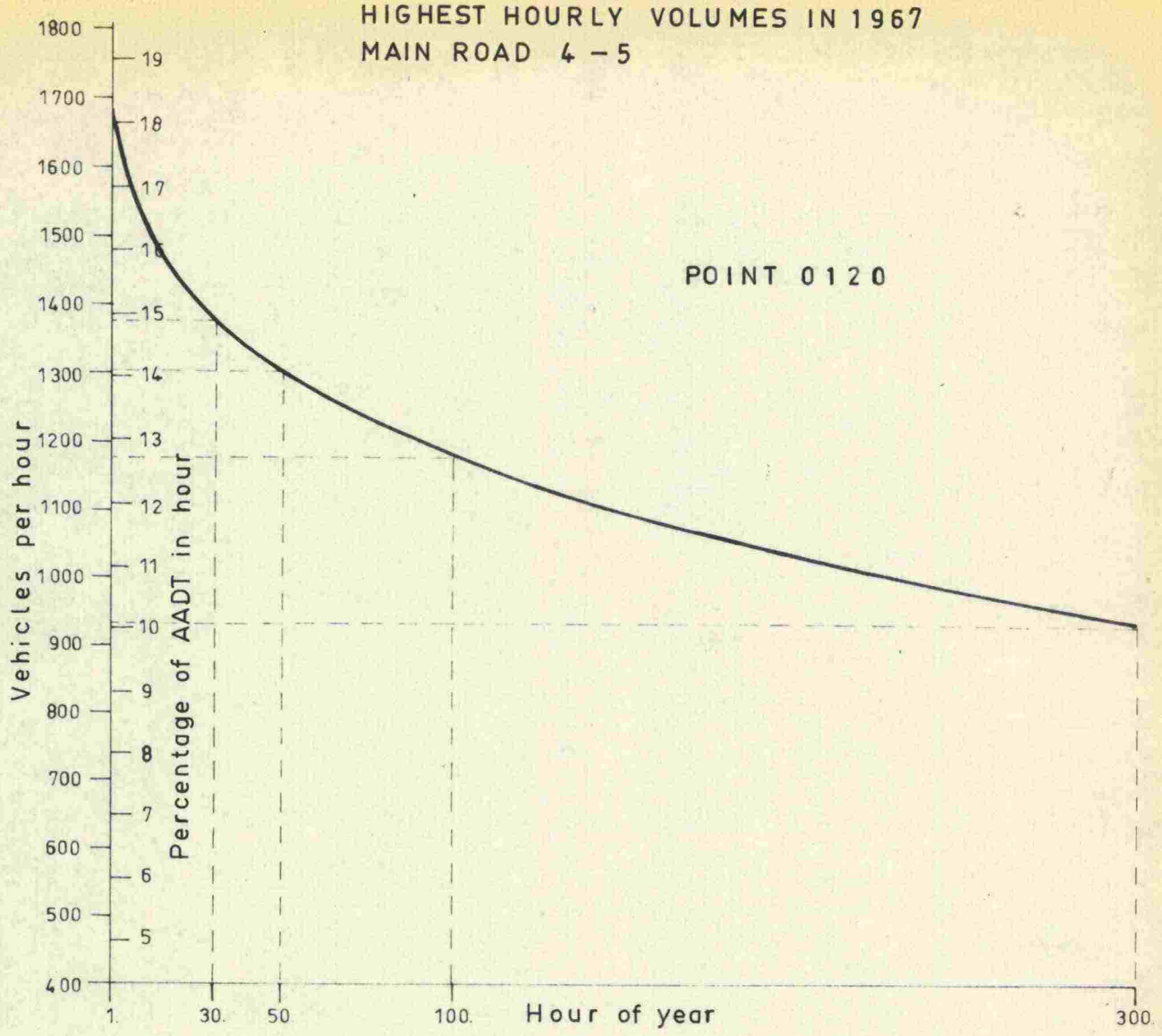
Daily traffic, vehicles



Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
8 549	8 557	8 479	8 402	8 822	8 778	9 462

Daily traffic, vehicles

Figure 20
HIGHEST HOURLY VOLUMES IN 1967
MAIN ROAD 4 – 5



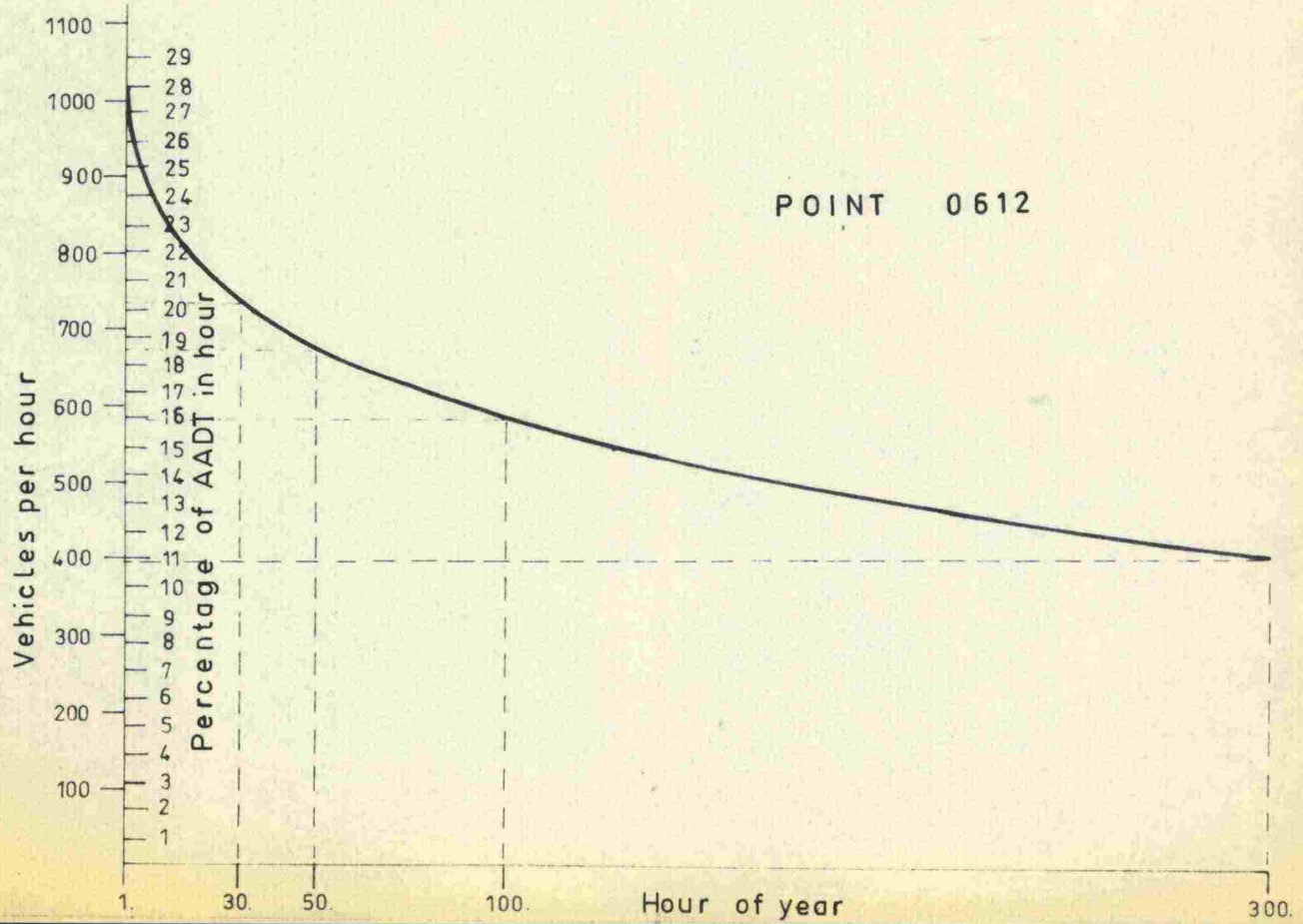


Figure 21

CARGO FLOWS IN 1966, AVERAGE WEEKDAY TRAFFIC
MAIN ROAD 4-5, COUNTING POINT 4
NATIONAL TRAFFIC FLOW STUDY IN 1966

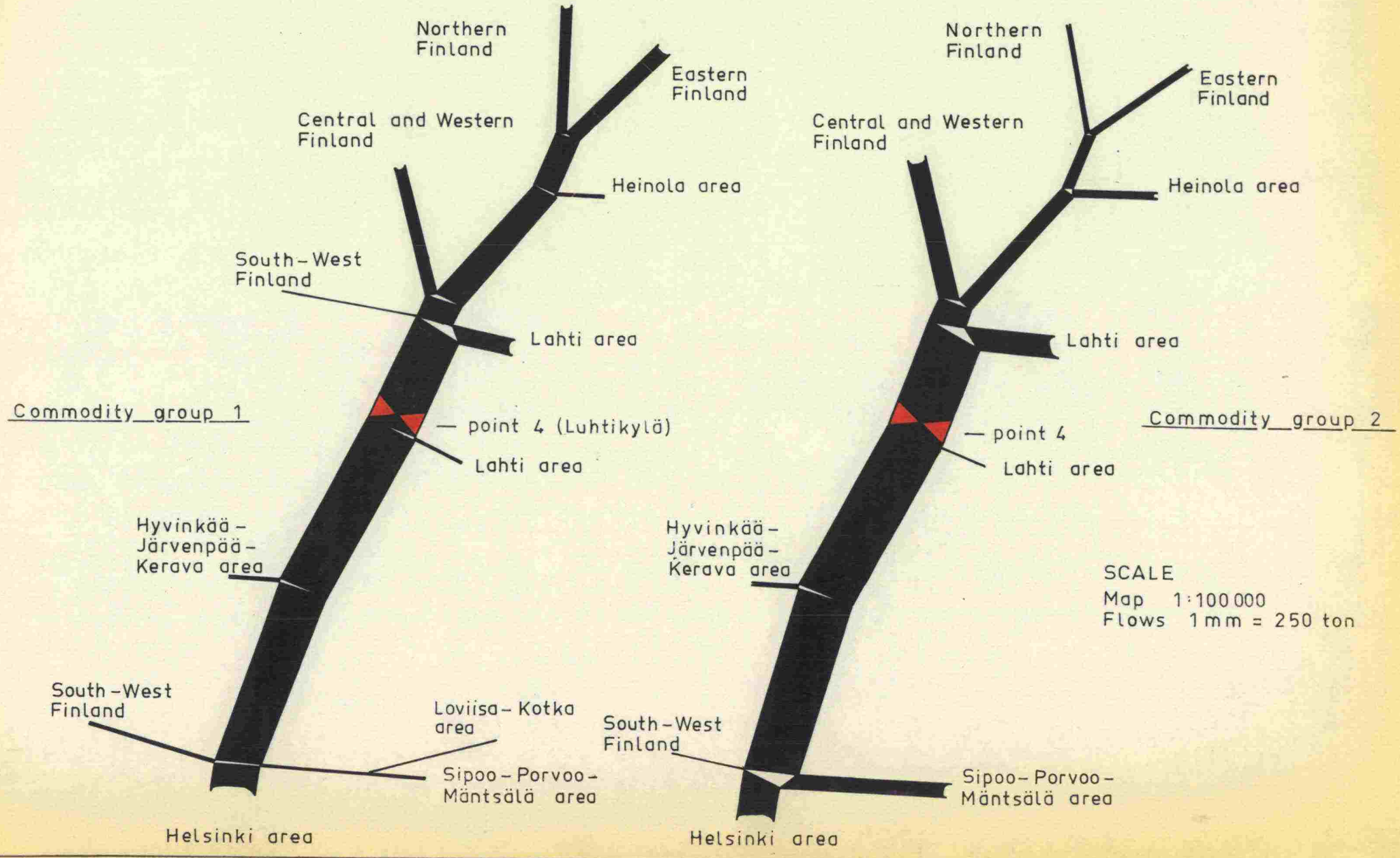


Figure 22
CARGO FLOWS IN 1966, AVERAGE WEEKDAY TRAFFIC
MAIN ROAD 4 – 5, COUNTING POINT 4
NATIONAL TRAFFIC FLOW STUDY IN 1966

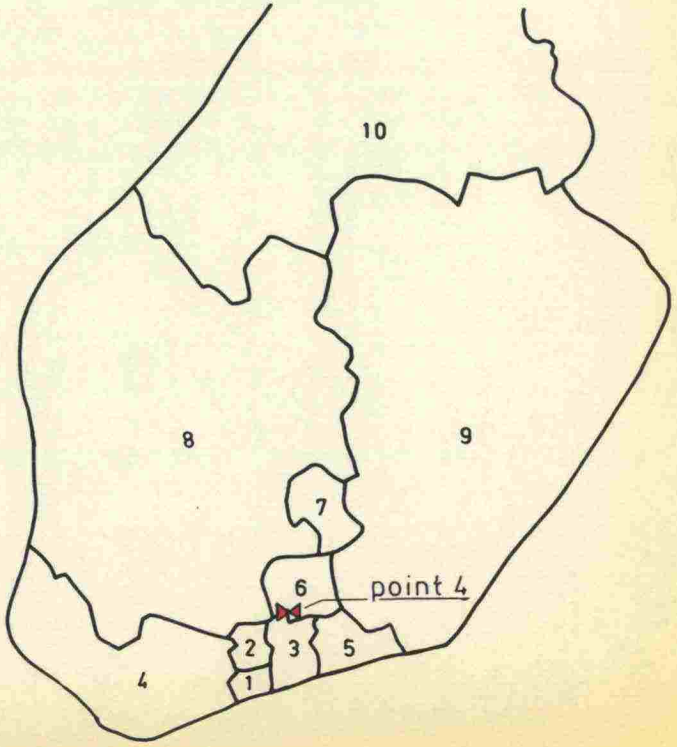
Commodity group 1 (tons):
industrial raw materials, building suplies and machines; solid fuel, liquid fuel

areas	1	2	3	4	5	6	7	8	9	10	Σ
1	–	–	2	6	–	352	29	226	353	346	1314
2	–	–	–	–	–	39	0	17	23	2	81
3	2	–	0	–	–	25	7	9	3	–	46
4	0	–	1	0	–	32	–	15	18	4	70
5	2	–	–	–	–	–	–	6	4	–	12
6	294	23	18	7	1	5	–	4	–	–	352
7	40	1	–	3	–	–	–	–	–	–	44
8	153	–	5	29	–	4	–	–	4	–	195
9	204	9	3	9	–	–	–	0	–	–	225
10	74	–	–	3	–	–	–	–	–	–	77
Σ	769	33	29	57	1	457	36	277	405	352	2416

Commodity group 2 (tons):
foodstuffs, industrial products; piece goods, other goods

areas	1	2	3	4	5	6	7	8	9	10	Σ
1	–	–	–	–	5	670	163	444	103	103	1488
2	–	–	–	–	–	19	5	6	12	6	48
3	6	–	2	–	–	210	43	299	107	–	667
4	–	–	–	–	–	14	–	28	0	–	42
5	–	–	–	–	–	–	–	–	–	–	–
6	104	11	40	8	–	15	–	2	2	–	182
7	78	27	5	10	–	2	–	–	–	–	122
8	66	17	36	13	–	–	–	–	3	–	135
9	96	21	3	3	–	–	–	–	–	–	123
10	8	–	–	–	–	–	–	–	–	–	8
Σ	358	76	86	34	5	930	211	779	227	109	2815

Areas:
1. Helsinki area
2. Hyvinkää – Järvenpää – Kerava area
3. Sipoo – Porvoo – Mäntsälä area
4. South – West Finland
5. Loviisa – Kotka area
6. Lahti area
7. Heinola area
8. Central and Western Finland
9. Eastern Finland
10. Northern Finland



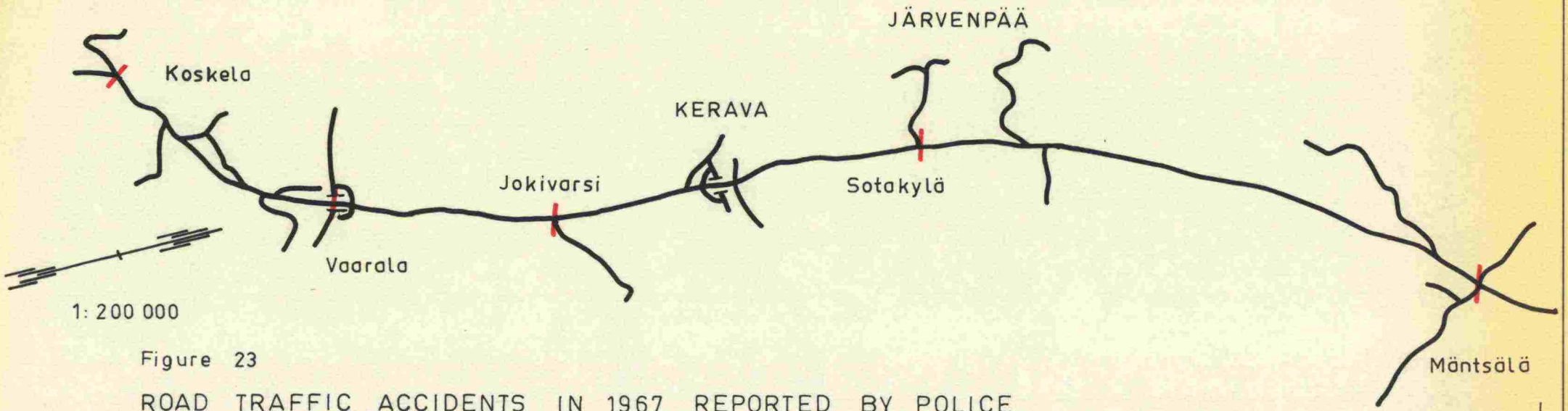


Figure 23

ROAD TRAFFIC ACCIDENTS IN 1967 REPORTED BY POLICE
MAIN ROAD 4 – 5, SECTION KOSKELA – MÄNTSÄLÄ

Road section	Length km	AADT – 67	Accidents		
			Amount	/10^8 driven km	/ km
Koskela – Vaarala	9.7	15 700	76	137	7.8
Vaarala – Jokivarsi	8.3	9 600	31	106	3.7
Jokivarsi – Sotakylä	13.9	6 300	24	75	1.7
Sotakylä – Mäntsälä	21.4	4 800	38	101	1.8
Total	53.3	7 900	169	109	3.2

Figure 24

ROAD TRAFFIC ACCIDENT REPORTED BY POLICE IN 1967

Type of accident

- fatal
- injurious
- property damage

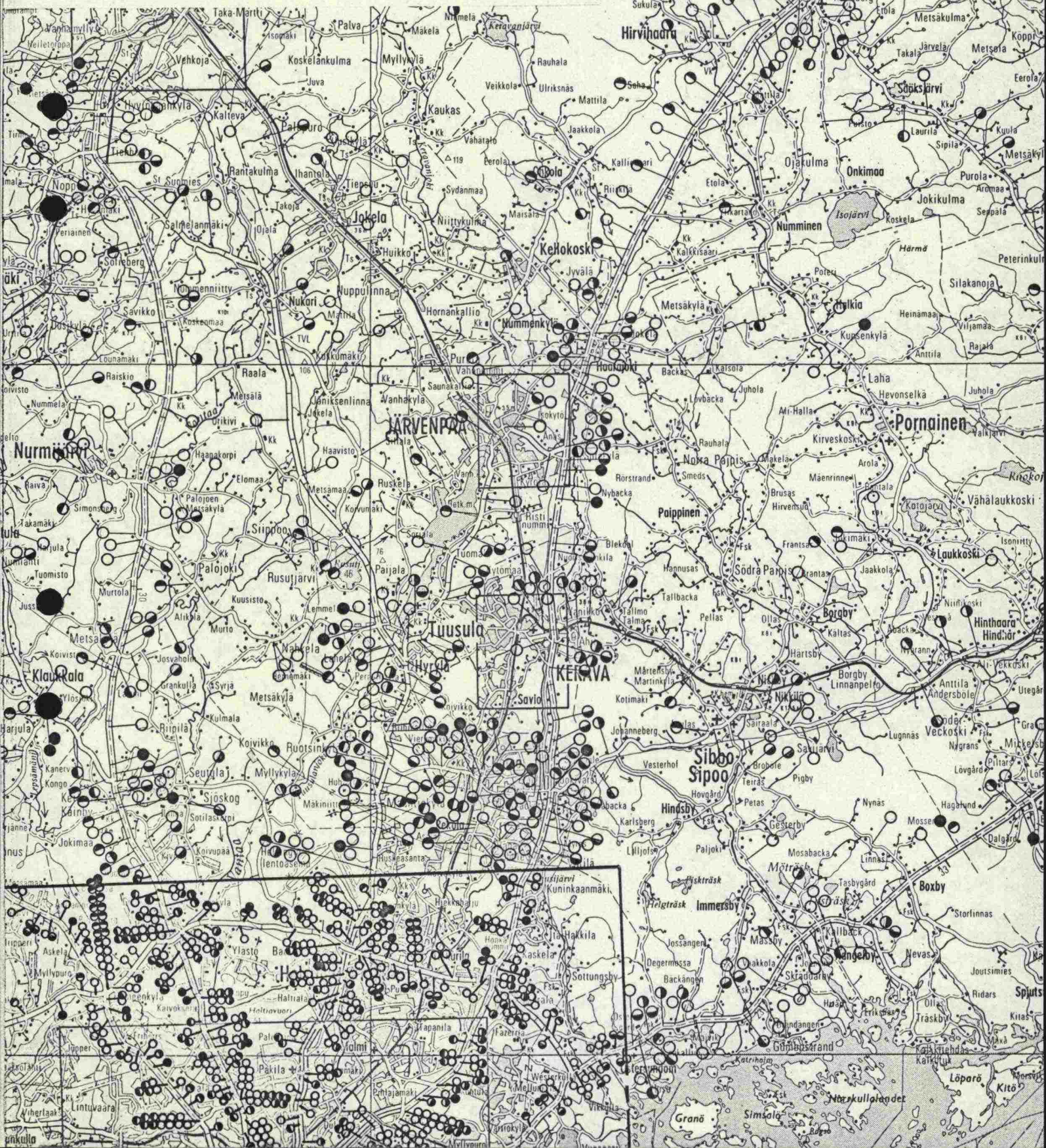
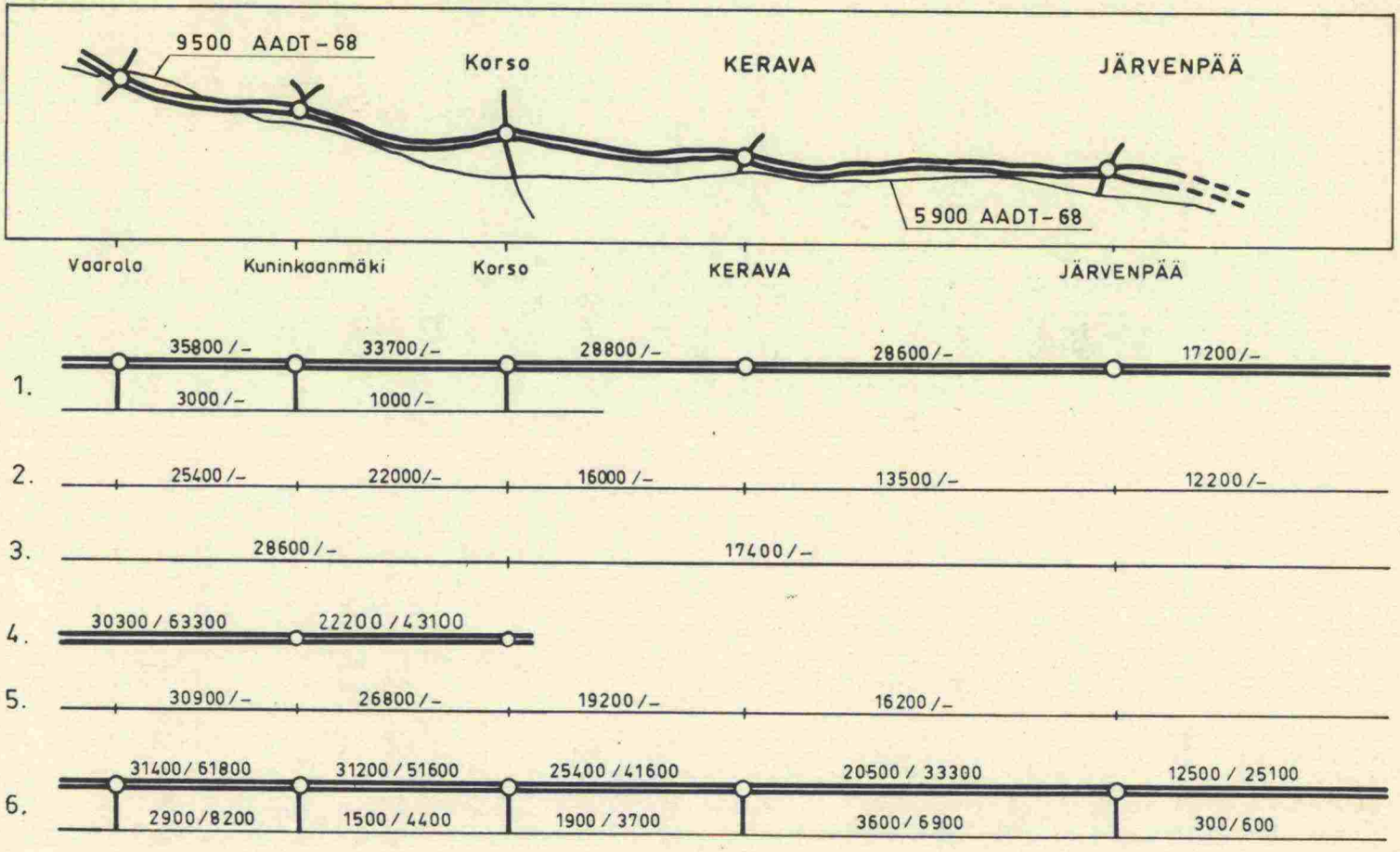

Sulkava
Niemenkylä
Kuusela
Haarala
Puikka
Riitakyto
Sahaj
Metsälä
Erola
Pihlajamäki
Sölinkää
Lukko
Ojala
Kilpiä
Koukkalampi
Ahola
Riihelä
Simola
Johannesberg
Marjala
Soukka
Järvelä
Turrinkylä
Paloniemi
Kotkakoski
Porrassuo
Kirkkivuori
Homma
Eerola
Mänsälä
Lakehisto
Sukula
Hirvihaara
Metsäkulma
Koppi
Takala
Metsola
Söksjärvi
Laurila
Kuula
Sipila
Ojakulma
Onkimaa
Purola
Aromaa
Jokikulma
Seppala
Numminen
Isojärvi
Koskela
Härmä
Peterinkulma
Kelokoski
Jyvälä
Silakanoja
Mylkia
Heinämaa
Viljamaa
Kupsenkylä
Rajala
Metsäkylä
Hornankallio
Nummenkylä
Nuppulinna
Nukori
Savikko
Koskeomaa
Nummenniitty
Jokela
Huikko
Niittykulma
Marsala
Sydänmaa
Jaakkola
Kallioniemi
Ojola
Etola
Kalkkisaari
Kokkumäki
Raala
Raiskio
Nummela
Metsälä
Orikivi
Haanakorpi
Elomaa
Haavisto
Ruskela
Metsämaa
Korvumäki
Palojoen Metsäkylä
Simonsberg
Takamäki
Siippoo
Palojoki
Rusutjärvi
Tuomisto
Murtola
Kuusisto
Lemmel
Alikylä
Murto
Metsola
Koivisto
Nahkela
Josvaholm
Klaukkala
Grankulla
Syrjä
Metsäkylä
Kulmala
Riipilä
Koivikko
Ruotsinkylä
Seutula
Myllykylä
Sjöskog
Kainby
Jokimaa
Ilentoasema
Kuninkaanmäki
Hakkila
Kaskela
Sottungsby
Tapanila
Pakila
Lintuvaara
Viherlaak
Hallila
Haltiavuori
Kaivoksela
Askela
Myllypuro
Ylasto
Jüpper
Nurmijärvi
Järvenpää
Tuusula
Kerava
Savio
Hyrylä
Nikkilä
Saksjärvi
Sibbo Sipoo
Pornainen
Nora Pajnis
Paippinen
Vähälaukkoski
Laukkoski
Södra Parnis
Borgby
Hinthaara Hindsör
Hindsby
Immersby
Boxby
Mosabacka
Gesterby
Nynäs
Hagalund
Mossen
Dalgård
Storfinnas
Nevas
Joutsimies
Ridars
Träskby
Gumbosand
Löparö
Kitö
Granö
Simsalö
Narskullalandet
Laha
Hevonselkä
Juhola
Kirveskoski
Rauhala
Nybacka
Brusas
Hirvensuo
Kotojärvi
Isonitty
Frantsas
Jaakkola
Tallbacka
Pellas
Kaltas
Hartsby
Borgby Linnanpelto
Anttila Andersböle
Veckoskoski
Lugnnäs
Nygrans
Vesterhof
Brobole
Pigby
Hovgård
Petas
Karlsberg
Lilljofs
Paljoki
Mosabacka
Tasbygård
Storfinnas
Kallback
Nangelby
Massby
Skräddarby
Backängen
Degermossa
Jossangen
Sottungsby
Kaskela
Hakkila
Kuninkaanmäki
Ilentoasema
Huhtaasanta
Kaivoksela
Haltiavuori
Hallila
Myllypuro
Askela
Ylasto
Jüpper
Pakila
Lintuvaara
Viherlaak
Tapanila
Fazerila
Ulmi
Westerkulla
Mellunmäki
Virkkala
Myllypuro
Kirkkonummi
Katrinholm
Gumbosand
Katrinehamn
Kattelbo
Kattelbo
Narskullalandet
Granö
Simsalö
Löparö
Kitö
Mörsvik
Sjuts
Kitas
Ridars
Joutsimies
Nevas
Mäss

Figure 25

TRAFFIC FORECAST
AADT IN 1980 / 2000



1. Regional Plan Association of Helsinki
2. Growth-factor forecast based on AADT-65
3. —"— —"— national traffic flow study in 1966
4. Helsinki Metropolitan Transportation Study
5. Forecast used in economic justification
6. Forecast used in final engineering

5. Economic Justification

In order to find out the economic justification of the Project the development of the levels of service on the section and the profits as road user benefits of the planned investment were exanimed.

5.1 Level of Service

The level of service has been judged by means of the method presented in the HCM 1965[1]. The development of the level of service on the road section has been described in Table 2 (p. 38). The 30th highest hour is a design criterion for rural highways in several countries. The 300th highest hour represents the highest hourly traffic volumes on this road during weekdays.

The capacity of the existing road is exceeded at the 30th highest hour up to Korso in 1969-70 and even on the section with lowest volumes - Kerava-Järvenpää - as early as in 1974. During peak hours on weekdays the speed of traffic will also become quite slow and traffic disturbances and congestion will be quite common. In the examination of the service volumes and levels of service of the road sections, account has not been taken of the effect of intersections.

The development of the level of service on the radial arteries of Helsinki is given in Figures 26 and 27 (p. 39 and p. 40). The development has been examined in connection with the clarification of the need of trunk road construction in 1969-80 mentioned above.

5.2 Road User Benefits

In order to find out the economy of the Project road user benefits, composed of benefits in vehicle, time and accident costs, were examined.

The formation of the unit values of vehicle costs is given in Table 3(p. 41). These are based on foreign studies revised to some extent in Finland. The light vehicles mentioned in the Table include cars and vans and the group of heavy vehicle consists of lorries and buses. The 0-alternative means the existing road and the I-alternative the planned motorway.

---

[1] Highway Capacity Manual 1965. Highway Research Board, Washington D.C., 1965.

The unit values of vehicle and time costs are given in Table 4 (p. 42). The time costs used are based on foreign studies and they are:

Year	Fmk/h · vehicle	
	Light vehicle	Heavy vehicle
1975	4.39	12.97
1980	5.24	15.49

Table 5 (p. 43) gives the combined benefits in vehicle costs and time costs by road sections. Traffic volumes of Forecast No. 5 given in Figure 25 (p. 34) have been used in this calculation.

In the determination of accident cost figures describing the degree of accident obtained from foreign studies were used:

- on existing road 340 accidents/10^8 km driven
- on motorway 140 - " - - " -

When these figures are compared with those given in Table 23 (p. 32) it must be borne in mind that according to Finnish studies only about one-half of traffic accidents are informed to the Police.

The unit costs of accidents have been obtained from Finnish studies. They are:

- in 1975 5 484 Fmk
- in 1980 6 335 "

On the basis of the above the road user benefits of the Project are:

Component	Benefit 1 000 Fmk/year	
	1975	1980
Vehicle and time costs	9 225	19 777
Accident costs	1 558	2 183
Road user costs	10 783	21 960

5.3 Construction Costs

On the basis of today's stage of design the following estimate of construction costs has been obtained:

	Million Fmk		
1. Construction costs			79
1.1 State financing		76	
- motorway with interchanges	69		
- approaches to communities	7		
1.2 Works financed by communes		3	
2. Acquisition costs			15
Overall costs			94

The costs of construction included in the Loan Programme are consequently 76 Million Fmk.

5.4 Economy

In order to find out the economy of the Project the assumed profit of the planned investments, the benefits as percentage of costs in 1975 and in 1980 were calculated. The overall costs of the Project, 94 Million Fmk, were used as investments. Adding the interest costs (rate of interest 6 per cent) caused by investments during construction, the cost to be used in economic justification of the Project is 99 Million Fmk.

The percentages of profit are:

- 1975 10.9 %
- 1980 22.2 %

The benefits in road user costs obtained during 1972-81 discounted with a 7.5 % interest to 1972 covers the total cost of the Project, 99 Million Fmk.

Table 2

GEOMETRY AND LEVEL OF SERVICE, MAIN ROAD 4 - 5, SECTION TATTARIHARJU - JÄRVENPÄÄ

Road section	Length km	Sight distance ≥ 460 m per cent %	Upgrades and downgrades m/km	Width of roadway m	Shoulders m	Avg. highway speed km/h	Level of service	Service volume at peak hour		Year when traffic vol. = service vol. at peak hour	
								30th[1]	300th[2]	30th	300th
Vaarala - Kuninkaanmaki	3,5	51	11,5	7,0	2 · 1,5	100	B C D E	560 1060 1500 1900	480 920 1350 1710	.. .. (1967) 1969	.. (1967) 1970 1972
Kuninkaanmäki - Korso	4,5	68	10,9	7,0	2 · 1,5	100	B C D E	630 1130 1540 1900	550 990 1400 1730	.. .. (1967) 1970	.. (1967) 1970 1973
Korso - Kerava	5	68	10,9	7,0	2 · 1,5	100	B C D E	630 1130 1540 1900	550 990 1400 1730	.. (1965) 1970 1972	.. 1969 1974 1978
Kerava - Järvenpää	7,5	74	10,9	7,0	2 · 2,0	100	B C D E	650 1150 1540 1900	570 1010 1400 1730	.. (1965) 1970 1974	.. 1970 1974 1982

[1] Trucks and buses 5 per cent, hourly volume 0.15·AADT

[2] - " - 14 - " - - " - 0.10·AADT

Figure 26
TRAFFIC VOLUMES ON RADIAL MAIN ROADS OF HELSINKI IN 1965–80

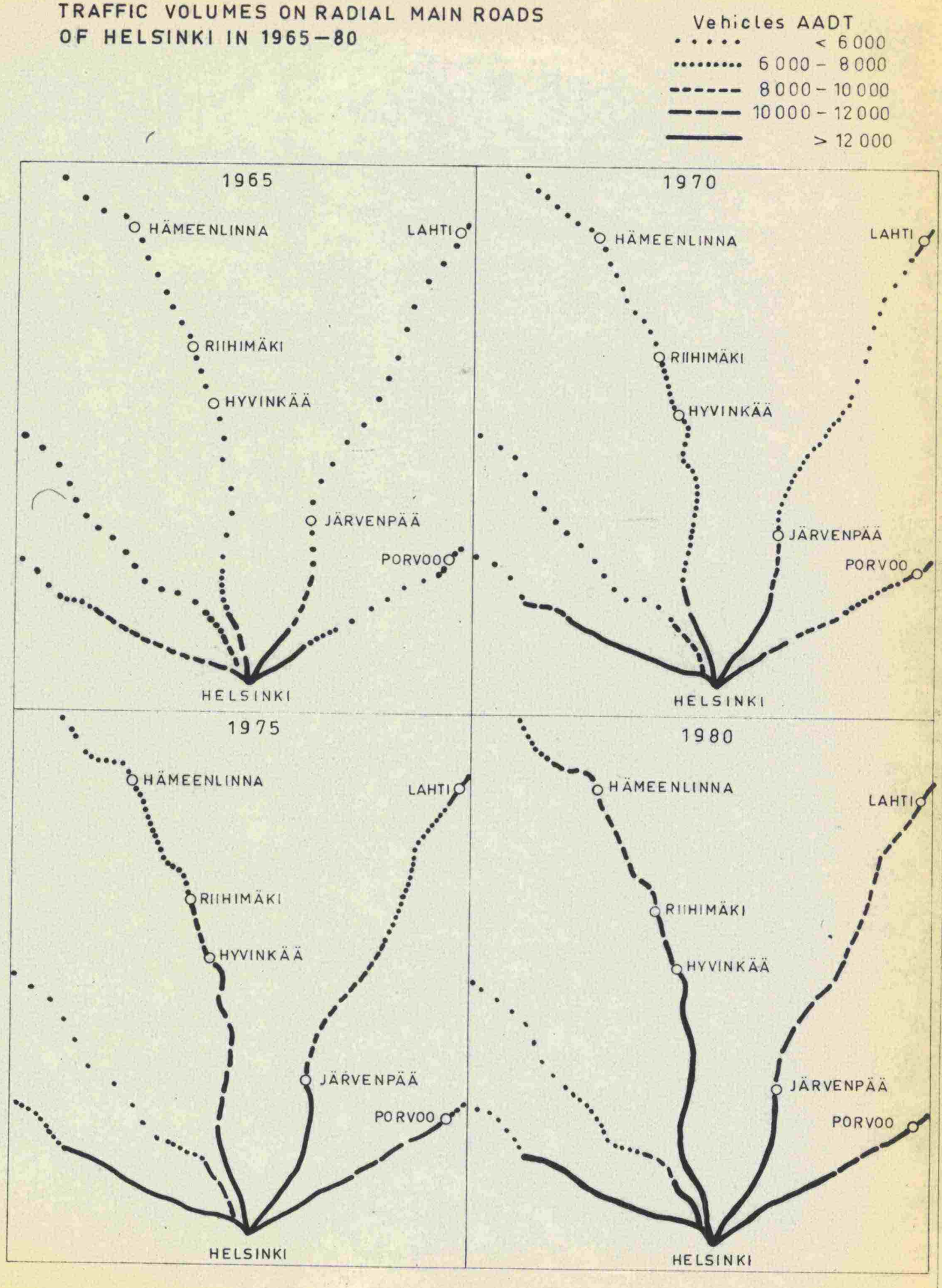


Figure 27
LEVELS OF SERVICE ON RADIAL MAIN ROADS OF HELSINKI

Level of service:

..... = C
-73

– – – = D
-76

——— = E
-83

and the year when 30 th highest hour = service volume

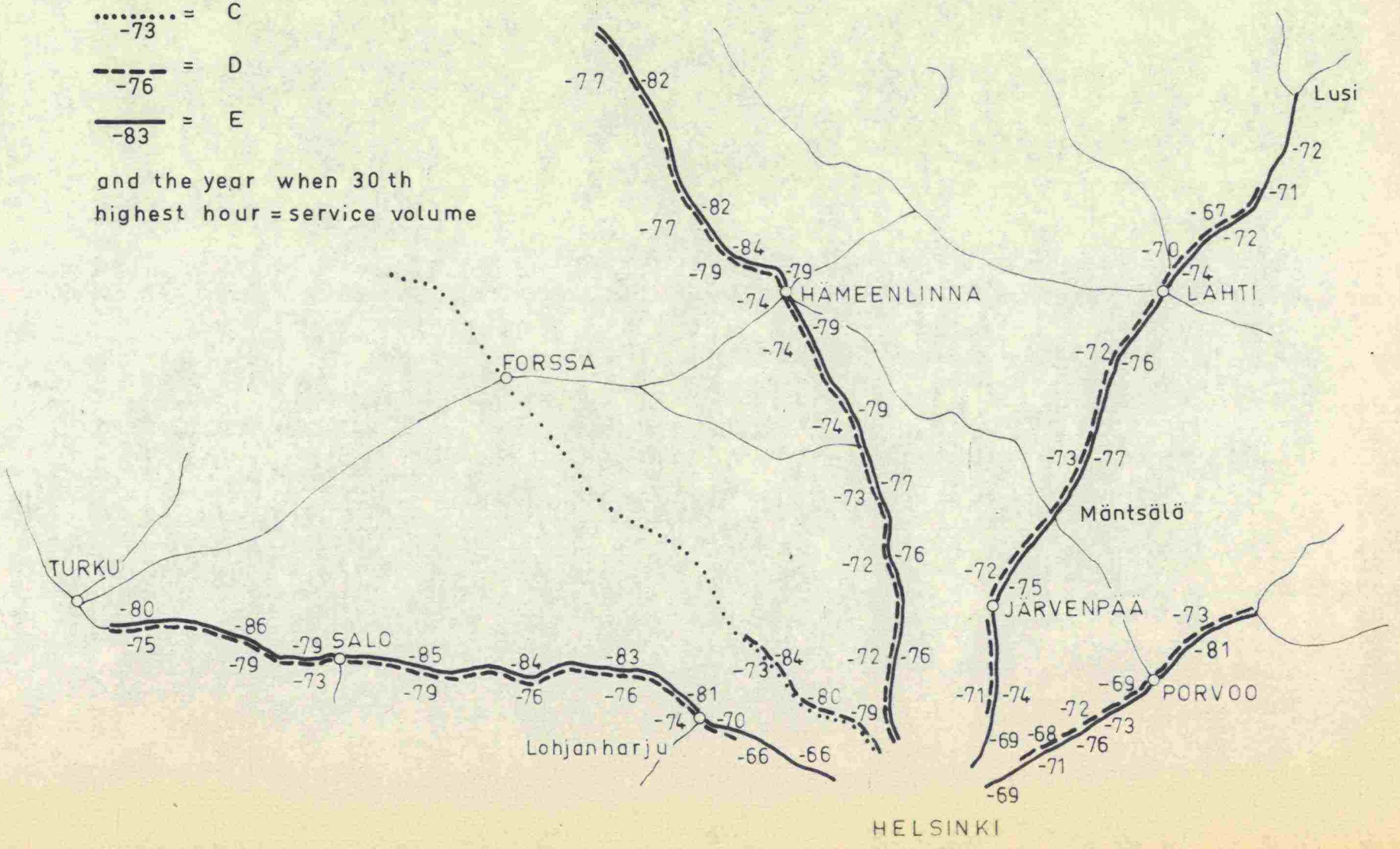


TABLE 3
VEHICLE COSTS IN 1975 AND 1980, SECTION TATTARIHARJU - JÄRVENPÄÄ
MAIN ROAD 4-5 AND PLANNED MOTORWAY

Alternate /year	Gross section of the road	Type of surface	Gradient class index m/km	Curvature index g/km	Running speed km/h	Vehicle costs p/km											
						Light vehicles						Heavy vehicles					
						Fuel	Lubri-cant	Repair	Tires	Amorti-sation	Total	Fuel	Lubri-cant	Repair	Tires	Amorti-sation	Total
0/1975	10/7	paved	11.5	6	39	2.34	0.33	2.78	0.43	3.45	9.33	6.99	1.18	9.35	3.74	9.98	31.24
	"	"	11.5	6	37	2.37	0.34	2.82	0.44	"	9.42	7.11	1.20	9.50	3.80	"	31.59
	"	"	10.9	2	41	2.28	0.33	2.72	0.42	"	9.20	6.84	1.15	9.15	3.66	"	30.78
	"	"	10.9	2	48	2.20	0.31	2.62	0.41	"	8.99	6.43	1.08	8.60	3.44	"	29.53
	11/7	"	10.9	7	53	2.15	0.31	2.56	0.40	"	8.87	6.54	1.10	8.75	3.50	"	29.87
I/1975	M	paved	15	28	85	2.13	0.30	2.54	0.39	3.45	8.81	7.82	1.32	10.45	4.18	9.98	33.75
	"	"	11	28	84	2.12	0.30	2.52	0.39	"	8.78	7.55	1.27	10.10	4.04	"	32.94
	"	"	11	28	86	2.10	0.30	2.50	0.39	"	8.74	7.59	1.28	10.15	4.06	"	33.06
	"	"	8	16	91	2.10	0.30	2.50	0.39	"	8.74	7.48	1.26	10.00	4.00	"	32.72
	"	"	7	14	93	2.12	0.30	2.52	0.39	"	8.78	7.55	1.27	10.10	4.04	"	32.94
0/1980	10/7	paved	11.5	6	33	2.42	0.35	2.88	0.45	3.45	9.55	7.33	1.23	9.80	3.92	9.98	32.26
	"	"	11.5	6	30	2.45	0.35	2.92	0.45	"	9.62	7.44	1.25	9.95	3.98	"	32.60
	"	"	10.9	2	34	2.39	0.34	2.84	0.44	"	9.46	7.22	1.22	9.65	3.86	"	31.93
	"	"	10.9	2	42	2.27	0.32	2.70	0.42	"	9.16	6.84	1.15	9.15	3.66	"	30.78
	11/7	"	10.9	7	45	2.20	0.31	2.62	0.41	"	8.99	6.73	1.13	9.00	3.60	"	30.44
I/1980	M	paved	15	28	80	2.12	0.30	2.52	0.39	3.45	8.78	7.67	1.29	10.25	4.10	9.98	33.29
	"	"	11	28	79	2.12	0.30	2.52	0.39	"	8.78	7.44	1.25	9.95	3.98	"	32.60
	"	"	11	28	83	2.10	0.30	2.50	0.39	"	8.74	7.55	1.27	10.10	4.04	"	32.94
	"	"	8	16	87	2.10	0.30	2.50	0.39	"	8.74	7.41	1.25	9.90	3.96	"	32.50
	"	"	7	14	90	2.10	0.30	2.50	0.39	"	8.74	7.48	1.26	10.00	4.00	"	32.72

TABLE 4

VEHICLE AND TIME COSTS IN 1975 AND 1980, SECTION TATTARIHARJU - JÄRVENPÄÄ MAIN ROAD 4-5 AND PLANNED MOTORWAY

Alternate /year	Cross section of the road	Type of surface	Cradient class index m/km	Curvature index g/km	Running speed km/h	Vehicle costs, p/km		Time costs, p/km		Total, p/km		Benefits (0-I) p/km	
						Light	Heavy	Light	Heavy	Light	Heavy	Light	Heavy
0/1975	10/7	paved	11.5	6	39	9.33	31.24	11.26	33.26	20.59	64.50	6.62	15.49
	10/7	"	11.5	6	37	9.42	31.59	11.86	35.05	21.28	66.64	7.27	18.26
	10/7	"	10.9	2	41	9.20	30.78	10.71	31.63	19.91	62.41	6.07	14.27
	10/7	"	10.9	2	48	8.99	29.53	9.15	27.02	18.14	56.55	4.58	9.58
	11/7	"	10.9	7	53	8.87	29.87	8.28	24.47	17.15	54.34	3.65	7.45
I/1975	M	paved	15	28	85	8.81	33.75	5.16	15.26	13.97	49.01	.	.
	"	"	11	28	84	8.78	32.94	5.23	15.44	14.01	48.38	.	.
	"	"	11	28	86	8.74	33.06	5.10	15.08	13.84	48.14	.	.
	"	"	8	16	91	8.74	32.72	4.82	14.25	13.56	46.97	.	.
	"	"	7	14	93	8.78	32.94	4.72	13.95	13.50	46.89	.	.
0/1980	10/7	paved	11.5	6	33	9.55	32.26	15.88	46.94	25.43	79.20	10.10	26.55
	"	"	11.5	6	30	9.62	32.60	17.47	51.63	27.09	84.23	11.66	32.02
	"	"	10.9	2	34	9.46	31.93	15.41	45.56	24.87	77.49	9.82	25.89
	"	"	10.9	2	42	9.16	30.78	12.48	36.88	21.64	67.66	6.88	17.36
	11/7	"	10.9	7	45	8.99	30.44	11.64	34.42	20.63	64.86	6.07	14.93
I/1980	M	paved	15	28	80	8.78	33.29	6.55	19.36	15.33	52.65	.	.
	"	"	11	28	79	8.78	32.60	6.65	19.61	15.43	52.21	.	.
	"	"	11	28	83	8.74	32.94	6.31	18.66	15.05	51.60	.	.
	"	"	8	16	87	8.74	32.50	6.02	17.80	14.76	50.30	.	.
	"	"	7	14	90	8.74	32.72	5.82	17.21	14.56	49.93	.	.

TABLE 5
VEHICLE AND TIME COST BENEFITS IN 1975 AND 1980, SECTION TATTARIHARJU - JÄRVENPÄÄ
MAIN ROAD 4-5 AND PLANNED MOTORWAY

Year	Road section	Lenght km	Benefits (0-I) p/km		Traffic volume AADT		Vehicle and time cost benefits 1000 mk/year	
			Light	Heavy	Light	Heavy	Light	Heavy
1975	Tattariharju - Vaarala	2.00	6.62	15.49	18 480	3 010	893	340
	Vaarala - Kuninkaanmäki	3.70	7.27	18.26	20 130	3 280	1 976	809
	Kuninkaanmäki - Korso	4.50	6.07	14.27	17 470	2 840	1 742	666
	Korso - Kerava	4.75	4.58	9.58	12 720	2 020	1 010	344
	Kerava - Järvenpää	7.70	3.65	7.45	10 580	1 720	1 085	360
	Total	22.65	.	.	..	..	6 706	2 519
1980	Tattariharju - Vaarala	2.00	10.10	26.55	24 690	3 690	1 820	715
	Vaarala - Kuninkaanmäki	3.70	11.66	32.02	26 880	4 020	4 233	1 738
	Kuninkaanmäki - Korso	4.50	9.82	25.60	23 320	3 480	3 761	1 480
	Korso - Kerava	4.75	6.88	17.36	16 700	2 500	1 992	752
	Kerava - Järvenpää	7.70	6.07	14.93	14 100	2 100	2 405	881
	Total	22.65	.	.	..	..	14 211	5 566